



FREMONTIA

A JOURNAL OF THE CALIFORNIA NATIVE PLANT SOCIETY



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FREMONTIA

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CALIFORNIA NATIVE PLANT SOCIETY

Dedicated to the Preservation of the California Native Flora

The California Native Plant Society (CNPS) is an organization of laymen and professionals united by an interest in the native plants of California, open to all. Its principal aims are to preserve the native flora and to add to the knowledge of members and the public at large by monitoring rare and endangered plants throughout the state; by acting to save endangered areas through publicity, persuasion, and on occasion, legal action; by providing expert testimony to government bodies; and by supporting financially and otherwise the establishment of native plant preserves. Much of this work is done through CNPS Chapters throughout the state. The Society's educational work includes: publication of a quarterly journal, *Fremontia*, and a quarterly *Bulletin* which gives news and announcements of Society events and conservation issues. Chapters hold meetings, field trips, and plant and poster sales. Non-members are welcome to attend.

The work of the Society is done mostly by volunteers. Money is provided by the dues of members and by funds raised by chapter plant and poster sales. Additional donations, bequests, and memorial gifts from friends of the Society can assist greatly in carrying forward the work of the Society. Dues and donations are tax-deductible.

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THE COVER: Native plant garden with leafy reed grass (*Calamagrostis foliosa*). Photograph by D. Fross.

CALIFORNIA NATIVE PLANT SOCIETY

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Upper Salinas Valley. Photograph by D. Fross.

FINDING HOME

by David Fross

Returning home last spring I took back roads to the Central Coast looking for wildflowers. Near Gorman, just beyond the intersection of Interstate Five and Highway 138, I stopped to admire the broad fields of California poppies covering the hills. Car after car stopped to view the poppies on that windy afternoon. After brief conversations, the people who were gathered near the cars began climb-

ing a long, steep slope up to the larger drifts of flowers. Groups coming down the hill offered encouragement to those just beginning. I watched this procession for a while, catching pieces of conversation and laughter on the wind. In their slow, deliberate movements up the slope, they appeared as pilgrims crossing a great floral tapestry, their labor taking them ever closer to some distant shrine. I wonder still, what

longing drew them up that hill? What is it we seek from these wild places?

We might take this thought further and ask ourselves another fundamental question. Why do we continue to encourage and promote the use of native plants in our gardens and landscapes? The question is especially relevant in light of the wealth of non-natives available, their clear suitability in our climates

and soils, and the ubiquitous examples of their successful use in the California landscape. Certainly there are compelling ecological, aesthetic, and functional reasons for the use of California natives, but something more is at work here. There is a dimension to this topic that remains largely unspoken and yet can be found in the ordinary desire to be among the poppies on a hillside near Gorman.

There are groups and institutions dedicated to the work of promoting the use of native species, as well as individuals who have been at this work most of their lives. Collectively this work has encompassed every habitat and soil imaginable in a state famous for its diversity. This lineage of knowledge is even more comprehensive when the influence of teachers and mentors is considered. Their wisdom and influence is memorialized in some of our cultivar names. Rich and carefully remembered stories surface with their

names: Theodore Payne, Lester Rowntree, Howard McMinn, Louis Edmonds, Ken Taylor, James Roof, Gerda Isenberg, Austin Griffiths, Dara Emery. Of course there are others—parents who encouraged gardening, botanists who coaxed us over the next hill, or the enthusiastic neighbor with the muddy clump of bulbs she insists you must have. I suspect we are all linked in this and like Antaeus¹, we are lost without a fundamental connection to the earth.

With such a rich history and evolved wisdom to draw on, why does so much of the cultivated California landscape look like some other place, or like no place at all? Why haven't the medians of our highways been filled with native grasses? In our Mediterranean climate, with its long summer drought, why does turf cover hundreds of square miles? Why haven't we featured the majesty of our native oaks in the center of our communities? The magnificent annuals of the flora

remain at the edge of our communities and most Californians must travel for miles to see spring wildflowers.

Why do generic landscapes, with no reference to place, dominate our communities? In much of California we are forced to look to the distant hills to experience this innate sense of belonging.

I believe the answer to these questions is clear: we have yet to make California, or the rest of the West, home. We came to this diverse and fragile landscape from earlier frontiers where conditions were not unlike those of northern Europe. We found this place different from our experience and were quick to misinterpret and misuse the landscape because we entered it carrying habits that are inappropriate and expectations that have proven excessive. We set about reinterpreting the landscape in an effort to fit our baggage. We asked our engineers to build a more familiar landscape and correct the dry summer. The dams, canals, concrete riverbeds, and storage basins of our complex water system demonstrate the enormity of this effort. The losses are seldom mentioned; riparian woodlands, granitic canyons, and broad wetlands were the price we paid. The impertinence of our culture can be heard in the words of William Mulholland as the first water poured from the Owens Valley into Los Angeles. "There it is, take it."

As a boy growing up in Long Beach, I did not encounter a single native plant in my neighborhood. My memories of home are full of camellias, eucalyptus, and the smell of orange blooms blowing in on Santa Ana winds. It was in the back corner of my grandparents' Arcadia home that I found the single thread, a massive coast live oak, that would connect me to the native landscape. Wallace Stegner² suggested in *Wolf Willow* that whatever landscape a child is exposed to early on will

¹Antaeus was the son of Gaia and Poseidon. He was a frightful giant who compelled all strangers to wrestle with him and defeated or killed them all. He was invincible for as long as he remained in contact with his mother (the earth), as she supplied him with his strength. Heracles discovered his secret and lifted Antaeus from the ground and strangled him.

All-native landscape, Santa Ynez. Photograph by D. Fross.



become the sort of gauze through which he or she will see all the world afterwards. If this is true, and certainly it has proven so for me, then how can we expect familiarity, affection, or a spiritual affinity to develop with our native flora if the core of the landscapes in our communities is foreign?

If we continue to remove all trace of nativity in our communities, we perpetuate a legacy of conquest and oppression set in place by the first Europeans on this continent. We cannot now return our grasslands to their perennial nature, any more than the coastal plain of Southern California can be returned to a broad oak savanna of which my grandparents' tree was a remnant. The force and magnitude of this change could foster bitterness and regret. How can we possibly counter this loss and find a broader understanding of community, an understanding that would include our native flora?

We might begin with gestures of regard, reintroducing native species back into our communities and gardens. Oaks and other native trees could line our boulevards and freeways. We might plant neighborhoods, corner lots, parks, and industrial complexes with natives until our communities include, rather than exclude, our flora. We could then say, "This is how we make our gardens here; these are the species that tell us we are home."

This could be misinterpreted as xenophobic. Others will point to all the native species in the hills beyond the urban border and say, "Enough!" They might suggest that we should be magnanimous and welcome all plants and garden styles, letting the great global landscape



Deer grass (*Muhlenbergia rigens*), Santa Ynez. Photograph by D. Fross.

play out across our fields. And why not? What do we stand to lose? Why shouldn't our communities wear a veneer of the exotic? These exotics have served us well and define much of our urban core. Certainly we have more pressing concerns than the regional character of our landscapes.

Perhaps. Yet I know for some, this issue is worthy of a life's work to which they bring a commitment founded in a love of place. Not an abstract love, but a precise love for particular canyons, bluffs, headlands, and valleys. Love that requires stands and acts, that is tangible in its success and painful in its failure.

Oak acorns. Drawing by C.Z. Taylor.



My daughter grew up playing a game in the deer grass, *Muhlenbergia rigens*, planted next to our house. In the backyard, her swing set sits under a large coast live oak, much like the oak from my grandparents' home. The remembered landscape of her childhood will be filled with these and other familiar native species. She has learned the rhythm of the acorns, the timing of deer grass panicles, and the names of the birds living there. The smell of the wet winter soil under oaks will bind her to this place just as the plants will form her view of the landscape. When she has a home of her own, I believe she will seek out these plants the way my mother sought out camellias, remembering the carefully tended plants from her father's garden.

It is easy to imagine native landscapes and philosophize about their use, but realistic, practical matters remain. The generic landscape is a clear demonstration of the practical. Foliage color provides a suitable example of an issue that results from the use of natives. Olive, gray, silver, and gold are not traditional garden colors for most California

²Wallace Stegner's *Wolf Willow*, a history, a story, and a memory of the last Plains frontier, was published in 1967. I paraphrase Stegner's memory of his childhood and his conviction that this period of his life and the Plains landscape colored the remainder of this life. Stegner was a Pulitzer Prize and National Book Award winner, and directed the Stanford University writing program for 25 years. He became a spokesman and defender of the American West. His Wilderness Letter of 1960 begins, "Something will have gone out of us as a people if we ever let the remaining wilderness be destroyed . . ."



A commonly planted California endemic, *Aesculus californica* (California buckeye), shown here in its native habitat. Photograph by D. Fross.

gardeners. “As moonlight unto sunlight is the desert sage to other greens,” wrote Wallace Stegner. In this case he was referring to basin sagebrush, *Artemisia tridentata*, but he might just as well have been speaking of the greens of the Mediterranean and desert regions of California. These colors remain foreign to most California gardens; it is the rich, watered colors of lawn and emerald of evergreen shrubs that permeate our communities. “It is strange how deeply colors seem to penetrate one, like scent,” said George Eliot, and the aroma of the cultivated California landscape is a

distinctive verdant green. In contrast, the olive-blue hills at the urban fringe remain a refuge for native colors—colors muted and hardened by drought, colors enduring and western.

In a recent essay Carol Bornstein remarked, “As a transplanted Michigander, it took a few years to develop an appreciation for gray-leaved plants. Now I am a complete convert, and am always looking for a new silvery specimen for my own jam-packed garden.” As Director of Horticulture at the Santa Barbara Botanic Garden, her conversion to these grays as well as to

other California colors is understandable. In her professional life she suddenly faced these colors daily; they became familiar and, I would guess, settling, even endearing in their seasonal rhythms. But what of others who arrive with a memory of green or who, like myself, were raised deep in the watered urban environment? How do we bring our western-colored natives to the garden and reveal the remarkable beauty of these colors to those with such a long tradition of green? And what of the colors of dormancy: amber, buff, brown, and saffron? Many of our native plants

are summer dormant and demonstrate this cyclic wisdom just when we are most customarily in our gardens. It is difficult to convince the gardening public with little or no tradition with these plants that the silvered silhouette of California buckeye, *Aesculus californica*, in their August garden has an evolved beauty of its own; that from this dormancy comes seasonal elegance unique to our Mediterranean climate.

The cultural requirements of many native plants pose challenges and specific garden concerns. Some genera, *Arctostaphylos* and *Ceanothus*, for example, come from well drained upland habitats and are often planted in heavy, poorly drained valley soils, thus predisposing the plants to problems. Many of our most reliable cultivars have been selected and tested for garden tolerance and disease resistance in an effort to overcome some of these contradictions. Some native plants are short-lived or fail in these situations. The chorus that follows these failures is, "Natives are not dependable."

What do we say to the enthusiastic gardener who bought a flannel bush, *Fremontodendron*, only to have it die a quick death in the heavy soil of his or her watered yard? We might suggest grasses, bulbs, selected wildflowers, or perhaps even a cottonwood or sycamore if they have the room. Each of these alternatives offers a specific garden challenge, as well as a departure from traditional garden-watering methods.

Many of our most popular native plants are simply too large for most gardens in urban and suburban landscapes. The *Ceanothus thyrsiflorus* 'Snow Flurry' in my garden was 18 feet tall and 35 feet wide after fifteen years. Genera such as *Prunus*, *Fremontodendron*, many *Ceanothus*, *Rhus*, and *Sequoia* will quickly dominate and overwhelm a small yard. Our flora is rich with species that will accommodate the smallest of gardens and requires only

careful, informed plant selection. Regrettably, our literature tends to focus on the larger category of natives while omitting some of the best choices for smaller gardens, genera such as *Heuchera*, *Ribes*, *Eriogonum*, *Dudleya*, and *Carex*.

Historically, native plants in California have been closely associated with three issues that have, in my opinion, harmed their performance in the landscape and continue to restrict their use. First, natives are usually grouped as water conserving, creating a preconception that can and many times does work against them. Clearly, a large share of the Mediterranean climatic portion of our flora is drought tolerant and that characteristic is carried into the garden from the wild. Some species, *Fremontodendron* for example, will require a period of summer drought for any chance of success in the garden. Most, however, are much more flexible in the garden, and some will grow in traditionally watered gardens as if they had evolved there. The result of

this drought tolerant preconception is the common use of native plants in the driest situations. They are repeatedly asked to shoulder the most difficult work in the garden, while sites with more generous water budgets or better soils are reserved for a wide expanse of turf or another exotic mix of species.

Warnings about the special needs of natives, whether a water issue or the necessity of well drained soils, can steer gardeners to other plants. Caution in the extreme may also convince gardeners to restrict water to the degree that the aesthetic of the garden is compromised. We have sacrificed much at the altar of water conservation. Many of our native plants are drought tolerant, but to prove their worth they need not be forced to endure continual stress.

Maintenance, or the lack thereof, is the second issue. Again, native plants have been grouped in a "low maintenance" or "no maintenance" category, and again a generalization has harmed their respec-

Native shrubs in spring, many of which are common in California gardens. Photograph by D. Fross.





Plants of the coastal scrub, here from Pt. Arguello. Photograph by D. Fross.

tive performance in gardens. It is difficult to generalize about maintenance, since site, budget, plant palette, and personal taste will determine the specific amount of maintenance required. My one-acre garden of mostly native plants requires about ten hours of maintenance each week, and my garden taste falls on the wilder side of the issue. A twelve-acre development in Santa Ynez designed with natives requires approximately eighty man-hours of maintenance a week and is finished in a tidy style. Both gardens are far from being maintenance free.

Native gardens can be found growing in many communities across the state. Community groups, institutions, and individuals plant them with great enthusiasm, and recent renewed advocacy has promoted native gardens in public schools. In my community a twelve-acre native garden has been created using plants from a strict regional palette. Some of these gardens are located in prominent places in our

communities and a few have signs that boldly proclaim that they are native gardens. When they are poorly maintained, or fail completely, they damage public acceptance of native plants and can create a perception that is difficult to counter. The success or failure of natives in the garden is dependent on regular, informed maintenance. Pruning dead wood, monitoring insect populations, replanting, dead heading, cutting back grasses, weeding, shearing, and managing irrigation is as necessary with natives as it is with any other group of plants used in cultivation.

The third issue is expectations: what can we and do we expect from these plants? Traditionally, they have been selected for use in the most problematic situations.

They are usually the first plants chosen for use on steep slopes with little soil remaining or are commonly planted in the driest of gardens. They have served admirably in these situations and have proven their tenacity and durability, but

many times the aesthetic of the plant is compromised by the site. There are native plants suitable for all garden styles and conditions and they can be utilized to serve most landscape functions from the common ground cover and flowering shrub to formal hedges and turf. We need only re-examine our expectations and re-evaluate the generalizations to imagine a more generous role for our native flora in the cultivated landscape.

It was over a hundred years ago that Theodore Payne began collecting wild species from the canyons and hillsides of Southern California with the idea of using these plants in California gardens. A long legacy of advocacy has followed his lead. Today there are hundreds of cultivars and species being used in western gardens and availability has become commonplace; many growers carry the better-known species and cultivars. Rare and unusual items can be found at botanic garden sales or the different native nurseries located up and down the state. Serving both aesthetic and functional needs, natives offer a palette as diverse as the people who have sought to make California home.

We have an opportunity with our gardens to renew and rediscover the native landscape. Consider it an act of regard. The principle requirement is patience. It begins with the simple act of planting and need not be grandiose: a *Dudleya* in a clay pot or a small drift of basket grass. With each gesture we open ourselves to a richer meaning of community and begin a long journey home.

[Editor's note: This article first appeared as, "Finding Home, the Evolving Native Garden," in Rancho Santa Ana Botanic Garden Occasional Publications, No. 2, symposium proceedings, Out of the Wild and Into the Garden, 1995.]

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THOUGHTS ON GARDENING WITH NATIVE PLANTS

by Carol Bornstein

"If we continue to remove all trace of nativity in our communities, we will perpetuate a legacy of conquest and oppression set in place by the first Europeans on this continent."

—David Fross

For almost a century, the voices of several passionate individuals have spoken of the horticultural merits of California's native flora. Some of these visionary horticulturists and landscape designers

include Lester Rowntree, Theodore Payne, Carl Purdy, Kate Sessions, Howard McMinn, Louis Edmunds, James Roof, Dara Emery, and Ralph Cornell. I often wonder what it was about our native flora that inspired them. Was it the beauty of an individual species or the context of its natural habitat that made them advocates for natives in the garden? Were they intrigued by the challenges of propagating and cultivating these little-known plants? Did

they believe that using natives would heighten awareness and appreciation for California's increasingly threatened flora, thereby helping to curb the seemingly relentless destruction?

A plethora of gardening books and articles in shelter magazines extol the virtues of gardening with native plants across America. Why is this such a hot topic today? Perhaps a look at why we garden in the first place would be revealing. Our

Calamagrostis foliosa (leafy reed grass) in perennial border at Santa Barbara Botanic Garden. Photograph by C. Bornstein.





Arctostaphylos insularis (island manzanita) in grove of *Lyonothamnus floribundus* ssp. *aspleniifolius* (fern-leaved Catalina ironwood) on Santa Cruz Island. Photograph by C. Bornstein.

gardening heritage is thousands of years old, beginning with the cultivation of food crops. Later, the concept of the pleasure garden evolved

in Persia, where the garden became a place to seek shelter from the elements and indulge one's senses, as well as to grow food. The very act of

gardening was and is manipulative (indeed, the phrase "natural garden" is a bit of an oxymoron), an artistic and scientific attempt to control the environment, tame the wilderness, and beautify one's surroundings.

Once the sole domain of the privileged class, today anyone with modest resources can have a garden. A sign of our democratic culture, we garden for the same aforementioned reasons, but also for mental therapy and physical exercise. For some, there is the challenge of successfully growing a finicky gem. For others, gardening provides an outlet for creative expression or garnering the admiration of our fellow gardeners. And for the native enthusiast, there is the personal reward that comes from enriching the natural world.

The stakes are different now than in biblical times, however. Much of the world is a mess, environmentally speaking. Ecosystems are threatened everywhere and biodiversity continues to decline at an alarming rate. And there is no question that our gardening practices contribute to the problem. Pesticides poison intended targets, but may also harm beneficial organisms and us. Fertilizers—often produced by questionable methods—promote exuberant growth that winds up in landfills instead of being returned to the soil as valuable compost. Quarrying of stone or decomposed granite for patios and paths, harvesting peat moss to amend soils, and downing trees to build fences and decks, all deplete and scar the natural landscape *somewhere*, invariably out of site of consumers. All these activities strongly suggest the need to live more lightly on the land, to garden more responsibly.

What can we as gardeners do? By creating ecological gardens—replicas of natural plant communities in our front and back yards—we can provide habitat for plants and animals that used to thrive in

our areas, thus restoring a bit of the natural environment. This is surely a compelling reason to landscape with natives. It is, however, a major departure from the traditional approach to gardening, where plants are selected primarily based upon their ornamental qualities, without regard to their origins. It is also new territory for garden makers, and benefits from an understanding of some complex biological processes, as well as acquiring a different aesthetic.

For those who find the naturalistic garden style too wild and radical, where do native plants fit in their gardens? When we can grow so many exotic species, why choose a native one? As an instructor, I pose these questions to my students whenever I teach a course on landscaping with California natives. The answers are fairly commonplace in some circles: natives are touted for the low-maintenance, drought-tolerant garden and for their adaptability, wildlife value, and low fertility requirements. All good reasons, to be sure, although each attribute is dependent upon which natives are chosen for a garden.

For example, a coast redwood is certainly not drought-tolerant when planted in hot interior valleys, nor is a manzanita adaptable to poorly drained soils. One must consider the natural *range* of a species instead of ascribing these qualities to *all* California natives. Such sweeping generalizations cause confusion and misconceptions about their care, not to mention fostering their reputation for being temperamental garden plants (albeit justified for some species). Another misconception is that natives need not be pruned. Any ecologist can rattle off the natural forces “pruning” away in the wild: animal browse, wind damage, fires, etc. Why can’t we follow suit? So many natives would become more acceptable as garden subjects if tended in more traditional ways. Gardeners simply need better examples and information to assist them in this task, whether pruning for cosmetic or rejuvenation purposes. Why withhold the care that would make them thrive, even if they can tolerate neglect?

Complicating the matter further is the issue of genetic contamination

[see O’Brien article, p. 16], wherein natives might be more inappropriate to plant than weedy exotics. Plant natives, but only certain kinds, and not over there! This mixed message demands clarity from the experts.

Occasionally, a student suggests that using native plants is a way to celebrate the surrounding natural landscape: “We live in California, not the tropics, not England, but here in this Mediterranean climate.” Ahh. Another voice extolling sense of place instead of the homogenization of our landscapes.

Rarely, however, is versatility or beauty mentioned, and I am dismayed by this. I like to think that there are native plants suitable for any garden style or cultural situation. We are only limited by our lack of imagination! (Of course, availability is an ongoing frustration.) As for aesthetic value, who would dispute the sculptural beauty of a manzanita, the majesty and quiet strength of a venerable oak, the incredible blues of *Ceanothus*, the intricate yet delicate branching patterns of buckwheats, the sweet perfume of hummingbird sage or yerba buena?

At some point, I hope the question “Why use natives?” becomes obsolete, that gardeners will no longer think they must choose between having an “environmentally correct” garden and a beautiful one. Instead, they will opt for both, and at the same time concentrate on improving their horticultural practices, double their efforts to preserve what remains of the natural landscape, and embrace the artistry and restorative aspects of gardening in harmony with nature. Let the skeptics be won over to natives by their beauty, a concept we can all relate to, despite our personal biases. For isn’t beauty one of the fundamental reasons we garden, after all?

***Ceanothus hearstiorum* (Hearst’s ceanothus) and *Dudleya brittonii* (a Baja California live-forever) with citrus tree in private garden. Photograph by C. Bornstein.**



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CONNECTIONS— SCHOOL GARDENS AND NATIVE PLANTS

by Carol J. Baird

The combination of kids with school gardens used to be almost a cliché, but now is more of an oxymoron. In fact, for more and more urban, suburban, and rural Californians under the age of 20, the touch and feel of Mother Earth is an *alien* phenomenon! (Try the quiz on page 14 on your child and on yourself and see if you agree!) As alarming as this state of affairs may be to horticulturists and plant enthusiasts, it is of

ten through college level, recognize the value of immediate and total involvement of kids in gardening programs. Even the State Superintendent of Education, Delaine Eastin, has become an enthusiastic advocate of school gardening programs. For one thing, gardens are a great hook for science and social studies curricula. For another, long-term experience with gardening can quite naturally expose students to other disciplines

- Providing an introduction to living things.
- Understanding nutrition.
- Meeting specific science curriculum requirements.
- Creating a sense of place.
- Recreating natural habitat.

The type of garden that educators envision is of course limited somewhat by the physical constraints of the schoolyard. But it is also limited by the goals and objectives set by the educator. If all that a teacher wants to provide for her students is experience with plants or an understanding of where their food comes from, a small vegetable garden might suffice. But gardens can offer students more in-depth learning if they include *native* plants. Here is where CNPS can play a vital role, both by providing guidance to educators, and by providing resources for obtaining appropriate California native plants.



Proud students posing in their Engelmann oak grove in El Cajon. Photograph by D. Hohimer.

even greater concern to educators, who must deal with the disconnect between the natural world and their students on a daily basis.

THE SCHOOL GARDENS REMEDY

One response for school personnel is to develop school gardens. Many educators, from kindergar-

ten through college level, recognize the value of immediate and total involvement of kids in gardening programs. Even the State Superintendent of Education, Delaine Eastin, has become an enthusiastic advocate of school gardening programs. For one thing, gardens are a great hook for science and social studies curricula. For another, long-term experience with gardening can quite naturally expose students to other disciplines

such as mathematics, fine arts, and language arts. School gardens fit well with The California Native Plant Society's (CNPS) mission of first attracting educators to the plant world, and then to the world of native plants. What do educators hope to achieve as they commit time, energy, and funding to gardens at their schools? Among the various goals articulated by educators are:

WHY USE NATIVES?

Without question, working with native plants will help to develop young people's understanding of native wildlife habitat. Clearly, however, it offers additional benefits: gaining a sense of place, becoming conscious of natural cycles, learning about the inter-relatedness of all living things, and of course, becoming aware of California's remarkable diversity!

The temptation for teachers

School garden with *Encelia californica* in the foreground in El Cajon (opposite, top). Fujidama shade structure and birdbath at Cajon Valley Middle School (opposite, bottom). Photographs by D. Hohimer.





Mural in school garden with *Encelia*, *Ceanothus*, and *Baccharis* at Cajon Valley Middle School, El Cajon. Photograph by D. Hohimer.

may be to rely on common gardening practices that, in the long run, are actually harmful to the environment: using plants inappropriate to the landscape, excessive fertilization, heavy year-round irrigation, and indiscriminate use of toxic chemicals. Doing so creates an unhealthy, artificial environment that requires constant maintenance in order to thrive. Even more serious is the negative impact of such gardening practices on the environment as garden chemicals seep into the groundwater, harming native flora, fish, and other wildlife, and polluting waterways.

In contrast, when the curriculum involves the use of native plants appropriate to the landscape, combined with healthy soil creation, drought-appropriate planting techniques, and natural control of pests, students are afforded countless opportunities to observe locally evolved ecological processes in action, to study interactions, and to participate in conservation activity through gardening. With its emphasis on natural habitats, students also are able to learn more about how native birds, insects, and other wildlife have evolved with these native plant species, making it possible for them to use the fruits, nectar, pollen, and microhabitat these plants provide.

THE CNPS SCHOOL GARDEN PROGRAM

One of the much-heralded programs of the new Statewide Education/Outreach Committee has been its on-going School Garden Program. What we hoped this program would accomplish was to help CNPS members and others inspire educators and students to develop an awareness, understanding, and love of California's native plants and natural habitats within a school garden setting. The Committee wanted

to provide CNPS chapter volunteers and teachers with information about establishing successful school garden projects, especially those that use California natives. To that end, we have sponsored two weekend workshops, one in the Bay Area, the other in Southern California. We were delighted that 45 of you showed up at the Bay Area workshop, and another 25 at the Southern California weekend!

We worked with the staff of the Aquatic Outreach Institute (AOI), a local nonprofit that specializes in teacher workshops, to develop the Bay Area workshop. AOI originally had focused on workshops about riparian systems, but not long ago expanded its offerings to include school gardens. The jointly sponsored Kids in Gardens Workshop provided an opportunity for CNPS educators to learn how to integrate their knowledge of native plants and gardening into the school curricula.

A GLIMPSE OF A WORKSHOP

Teachers and gardeners are eminently practical. At the CNPS Kids

QUIZ:

1. Where does your tap water come from?
2. Where does your garbage go?
3. How many days until the moon is full?
4. When was the last time a fire burned your area?
5. Name five edible plants that used to be found in your region.
6. Name five resident and five migratory birds in your area.
7. From where you are right now, point north.
8. What river basin (watershed) do you live in?
9. What kind of soil are you standing on?
10. What creek runs closest to your school?

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Ponds with circulating stream and bridge at Cajon Valley Middle School. Photograph by D. Hohimer.

in Gardens Workshop, we learned that being able to demonstrate concepts to kids counts a lot more than simply saying things. The workshop was organized in a manner that cleverly interspersed concepts with hands-on exercises. For instance, following a presentation on soils, participants conducted experiments on porosity and water retention using an array of different soil ingredients. Later that same day, we discussed mineral content and soil amendments and then went outdoors to conduct chemical tests of various soils.

Three teachers from local schools offered presentations about their own school gardens. They covered how the programs got started, problems in planning and organization, finding people to help construct the planting beds, the students' response to the program, and creative ways of integrating school curricula with school gardens.

A group of hands-on activities demonstrating propagation techniques, aptly named "Plant Parenthood," was perhaps the most popular part of the two-day workshop. We fashioned origami-pots for planting California poppy seeds. We learned how to do divisions of yarrow and cuttings of *Salvia clevelandii*. And we learned that some natives are more durable (i.e., kid-proof) than others.

On the second day, we explored the science of composting, and then created composting bins that use red worms to turn kitchen waste into rich soil. We were also treated to a very practical introduction to butterfly gardening, given by a local expert. We were able to provide participants with two binders: the *Teachers Resource Kids in Gardens* binder containing 450 pages of resources, activities, ideas, and management suggestions for integrating school gardens into the curriculum, and

Betsey Landis's *Southern California Native Plants for School Gardens*.

FUTURE PLANS

From discussions with CNPS members around the state, we have learned that there is a need for more of these workshops, so the Education/Outreach Committee is planning to offer at least two each year, in the northern and southern regions of the state. In our letter to the general membership, we share the CNPS vision of a future in which native plants and habitats are widely appreciated as essential for human well-being. To realize this vision, we must plant and nurture in young people the seeds of an enduring relationship with the natural world.

Carol J. Baird, California Institute for Biodiversity, 47 Quail Court, #111, Walnut Creek, CA 94596



A native sedge (*Carex subfusca*) used in a California garden. Photograph by D. Hohimer.

THE INTERSECTION OF CONSERVATION AND GARDENING: AN OVERVIEW OF THE CONSEQUENCES OF GROWING CALIFORNIA NATIVE PLANTS

by **Bart C. O'Brien**

[Editor's note: Common names have been included more sparingly than typical in this article because so many plants are mentioned.]

INTRODUCTION

In recent years public awareness has been growing regarding the positive attributes of native plant horticulture. We are indeed fortunate to be experiencing this trend

at a time when our native flora is under such aggressive assault from the consequences of our ever-expanding population. In our collective desire to do the right thing, however, we must also be aware of the possible negative consequences of growing California native plants in gardens and landscapes throughout our state. The purpose of this article is to provide an overview of these issues so that we, as individuals, may make informed decisions

about our horticultural activities and choices.

Each population of native plants in California is the result of complex interactions between that population's genetic heritage (as expressed in the individual plants) and the environment. Environmental influences include the biota that share the population's environment, and the physical aspects and biological processes of their native locality [e.g., geology, erosion, fire, floods, land

subsidence, mountain building, growth, death, soils, fertility, aspect, slope, climate, etc.). Human activities also impact these populations, but in ways that often are not in harmony with ongoing natural processes. Taken as a whole, however, it is a dynamic system that is readily influenced, but is difficult, if not impossible, to thoroughly manage in an appropriate manner. In my opinion, all land in California is “managed land” as it is under both the direct and indirect influence of human activities, and thus self-sustaining landscapes or unchanging environments do not exist.

Each individual garden, regardless of its size or content, is a microcosm of these interactions and processes. Planting, weeding, watering, mulching, feeding, fencing or caging, pest and disease control, pruning, and other horticultural activities have their parallels in the care and maintenance of native ecosystems. Stop weeding and the average garden will soon be filled with weeds. Stop watering and the average garden will soon be composed primarily of dead plants. Put in the wrong plant for a particular spot or plant it at the wrong time of year and it probably won’t survive. Spray the garden too often with pesticides and you may end up eliminating the beneficial insects that could have kept the undesirable ones in check.

Clearly the best option for the continuation of California’s diverse flora is to ensure that the natural processes that have produced our flora—including fires, floods, and activities of microbiotic and macrobiotic flora and fauna—continue unimpeded. At the same time, we will need to be more diligent in managing threats to the biologic integrity of our ecosystems, such as the control or elimination of aggressive exotic species, potential control of aggressive native plants, and control of herbivore populations in the absence of predator species.

From a strict conservation perspective, the paragon of responsible horticultural use of California native plants lies in the creation of gardens and landscapes using only site specific plants. But the question remains: how do our other native plant horticultural activities affect the greater landscape of California?

HORTICULTURAL PRACTICES

The act of propagating and growing plants for use in gardens, landscapes, restoration projects, and other purposes can also have unforeseen consequences. The propagules (cuttings, seeds, divisions, etc.) themselves may carry one or more viruses, fungal pathogens, or other diseases that may infect their wild relatives. Similarly, the soil mix in the container that the plant is growing in may harbor any number of pathogens that may affect other plants.

A number of our native geophytes (“ground lovers” such as plants with bulbs) are particularly sensitive to viral infection. The genus *Lilium* is particularly susceptible to tobacco mosaic virus. Vigorously growing plants frequently do not show symptoms of the virus, but stressed plants will show the characteristic splotchy pattern in their foliage. *Phytophthora* and other root rot fungi are easily spread by contaminated soils in nursery containers. The fungal pathogen, *Botryosphaeria ribes*, can be readily transported in the live tissue of container grown plants, and is responsible for branch dieback in manzanitas (*Arctostaphylos* spp.), Sierran redwoods (*Sequoiadendron*), silk tassels (*Garrya* spp.), and many other native plants.

Collecting seed or other propagules is part of an active selection process. The seeds that are easiest to reach are usually the ones that

are collected. Usually the others are not, and these include the seeds that were first to ripen and drop out of the seed capsule and those from the highest or lowest parts of the plant.



Silk tassel bush (*Garrya elliptica*). Photograph by D. Fross.

The selection process is further influenced by growing the seeds under nursery conditions, which favor those that germinate quickly and respond best to conditions in your nursery (watering regime, soil mix, fertilizing regime, pest control methods, chemical use, growing in nursery containers, etc.). The end result is a group of plants that has been selected to grow under that particular set of conditions. These plants are not necessarily the best or most representative plants to use in restoration, habitat creation, or other conservation projects. They are, however, likely to be good garden subjects.

GENETICS: SOME EXAMPLES

A Theoretical Example: California Poppy (*Eschscholzia californica*)

A simple way to think about the genetic consequences (genetic swamping and contamination) is to consider the following theoretical scenario. In the vast fields of

California poppy at Antelope Valley there are nearly always a few plants with white- or cream-colored flowers. If seeds from these flowers were collected and grown in Monterey in vast quantities and all the orange-colored flower forms were removed, the result would be a huge seed crop of white- or cream-colored California poppies. If this huge seed crop was then added back to the original population of orange-flowered plants in Antelope Valley, there would be an immediate effect—a disproportionate number of plants with white- and cream-colored flowers. If the white- and cream-flowering plants were present in large enough numbers, and were vigorous well-adapted plants, the long-term result could be that there would be more and more vigorous well-adapted plants with white- and cream-colored flowers (*genetic swamping*).

But what if the plants with white- and cream-colored flowers were not as vigorous or were poorly adapted to the conditions in Antelope Valley? Their genetic heritage would still mix with the orange-colored flower form, possibly to the

detriment of the population as a whole, influencing it in a negative way (*genetic contamination*). At this point in time, there is no way of knowing what the long-term result of the interaction of the two forms would be, because there are too many variables.

A Case History: Monterey Pine (*Pinus radiata*)

Rare and endangered species that occur in several discrete populations that have known genetic variability, or that have not yet been surveyed genetically, make up the bulk of the plants in the *CNPS Inventory*. *Pinus radiata* has a long history of commercial and horticultural use both in California and abroad. The Monterey pine is restricted to five localities worldwide. The three Californian native populations are found at Año Nuevo in San Mateo County, the Monterey peninsula in Monterey County, and the Cambria area in San Luis Obispo County. The two Mexican localities are located at the northern end of Cedros Island and at the higher elevations of Guadalupe Island in Mexico. Genetically, the

five populations are quite distinct from one another.

Due to its fast growth rate, the Monterey pine has become a very important source of wood and wood by-products in the southern hemisphere. Forestry officials in New Zealand obtained seeds from all five wild populations and have used them in their efforts to produce the best trees for plantation forestry purposes. To achieve these ends, the genetic material from the five wild populations was mixed. The resulting seed crops were then used to generate the large scale forestry plantations that are seen throughout the southern hemisphere today in New Zealand, Australia, South Africa, and Chile. Up to this point everything is fine—the genetically mixed plants are in the southern hemisphere and the five wild populations have not been affected—but there is more to this story. The seeds from the mixed New Zealand plantations continued to be harvested and sold, and since they were cheaper and more readily available than seed from any of the five wild populations, they were purchased and grown commercially in California. The resulting trees have been planted throughout coastal California. There are a number of compelling reasons why this activity is ill-advised.

Physically connecting discrete populations of rare plants can have dire consequences. The planting of large numbers of Monterey pine trees that essentially bridged the existing geographic gap between the Monterey peninsula and Año Nuevo populations has clearly had unexpected consequences as the arrival of the pine pitch canker (*Fusarium subglutinans*) has so aptly illustrated. This lethal non-native fungal pathogen was able to quickly spread throughout the Monterey peninsula and Año Nuevo populations due to the extensive presence of planted pines (Monterey pines and other susceptible pine species) in



California poppy (*Eschscholzia californica*) at Antelope Valley. Photograph by L. Vorobik.

the intervening area where there had been no native pines.

The planting of large numbers of new trees of unknown origin within or adjacent to a native wild population can adversely affect the native population. Planting large numbers of Monterey pines throughout the Monterey peninsula has led to a mixing of genotypes that may overwhelm the rarer elements of the population and may lead to the elimination of these unusual attributes.

Genetically Depauperate

Taxa: Nevin's Barberry
(*Berberis nevinii*)

Few of our native plants have thus far been shown to have remarkably low genetic variability. These plants are relatively immune to genetic swamping from mixing individuals among the populations. *Berberis (Mahonia) nevinii* has been in cultivation for decades throughout California, and it is the most commonly grown rare plant of the state. It has, almost without exception, been grown from seed. People in the nursery industry have long been aware that all the plants of this species look alike—even as young seedlings there is no apparent difference among the plants. *Berberis (Mahonia) nevinii* is the best known case of a Californian rare and endangered species that is relatively widespread geographically (it is known from Los Angeles, San Bernardino, Riverside, and San Diego counties). All but one of these natural occurrences is composed of one to a few individuals. Unpublished molecular studies from the early 1990s concluded that there is almost no inherent genetic variability in this species. In fact, only one population, at Vail Lake in Riverside County, contained demonstrable genetic diversity.

The implications of this study are twofold. The one population that contains genetic diversity must

be a high conservation priority. Secondly, the source of material of this shrub for landscape and garden purposes is not of particular concern. The only exception would be that all plantings in the vicinity of the one genetically diverse population should be grown from seed collected from throughout that population. This particular species may be vulnerable to genetic swamping from other *Berberis (Mahonia)* species that could hybridize with it—particularly from *B. (M.) fremontii*, *B. (M.) haematocarpa*, and *B. (M.) bigginsae*.



Vine Hill manzanita (*Arctostaphylos densiflora*) drawn by Emily Reid for *The Jepson Manual*, reprinted with permission of UC Regents.

Rare Taxa Known from a Single Locality

A number of horticulturally desirable native plants are currently known from only one locality and are members of genera that are known to hybridize. These plants may be especially sensitive to genetic swamping and contamination. Examples include: *Arctostaphylos imbricata*, *Brodiaea pallida*, *Calochortus tiburonensis*, *Cercocarpus traskiae*, *Clarkia imbricata*, and *Heuchera abramsii*. If any wild population of these plants are known to be in the vicinity, no other plant of that genus should be planted. A good example of this condition is *Arctostaphylos densiflora*, known only from the CNPS-owned Vine Hill Preserve in Sonoma County. *Arctostaphylos densiflora* was most likely always restricted to an unusual soil type: a deposit of acidic upper Pliocene marine sands. *Arctostaphylos* are generally bee-pollinated plants, and bees are known to for-

age up to three miles, therefore, ideally there should be no other *Arctostaphylos* species or hybrids planted within the “bee-forage” buffer zone from the Vine Hill Preserve.

Plantings of non-clonal *Arctostaphylos densiflora*, grown from seed collected from the preserve should be particularly encouraged in gardens and landscapes on the acidic sand deposit where it originally occurred, and within the aforementioned buffer zone. Plantings of named cultivars (even those attributed to this species) should be discouraged because the few surviving individuals of *Arctostaphylos densiflora* at the Vine Hill Preserve could be genetically swamped by planted cultivars in the buffer. Solely from the perspective of preventing genetic contamination, it would likely be in the best interests of the rare species that closely related common species of the same genus be actively eliminated from the buffer zone. It is interesting (and disquieting) to note that another rare manzanita (*Arctostaphylos bakeri*) also occurs naturally at the Vine Hill Preserve.

Monospecific Taxa with One Extended Population: Bush Anemone (*Carpenteria californica*)

A few of our native plants are monospecific genera (one species in the genus) that are found in one local or extended population. The use of these plants in gardens and landscapes is not of particular concern, especially when the plants are grown from seed collected with appropriate permits. The only exception to this would be if the plants were to be planted out in large quantities in or near the immediate vicinity of the wild population or if a clonal selection was to be planted out in quantity in or near the immediate vicinity of the wild population. The best example of this con-

dition in California is *Carpenteria californica*, the bush anemone, from one nearly continuous population in the foothills of the Sierra Nevada in Fresno County. Typically *Carpenteria* is grown from seed, and the number of plants that could be planted in or adjacent to the wild plants is not considered to be significant. However, there are several



Bush anemone (*Carpenteria californica*).
Photo credit unknown; its use courtesy of the Jepson Herbarium, UC.

clonal selections (cultivars) of this plant that are produced in large quantities. The most common cultivar is 'Elizabeth' and it has been propagated at a rate of between 1,000 and 5,000 plants per year. If all of these were planted in or near the wild population, they would definitely impact the population genetics and dynamics of this native population.

Other Genera with One Native Species and Monospecific Taxa

Common monospecific plants in our native flora present an interesting challenge to the conservation-minded gardener. Most of California's plants have not had their genetic diversity thoroughly assayed. In the case of narrowly or

widely disjunct populations, or otherwise separate subpopulations of these common plants, it is recommended that site specific or near site specific material be used in gardens and landscapes. For most other garden and landscape projects, the use of plants of unknown provenance would likely not be of critical conservation concern. There are exceptional cases where intergeneric hybridization involving some of these monospecific plants are known to occur in the wild (see below). The fact that these hybrids are known to exist does lead one to speculate on the possibility of introgression (hybridization followed by backcrossing to one of the parent species) between closely related genera, or to ques-

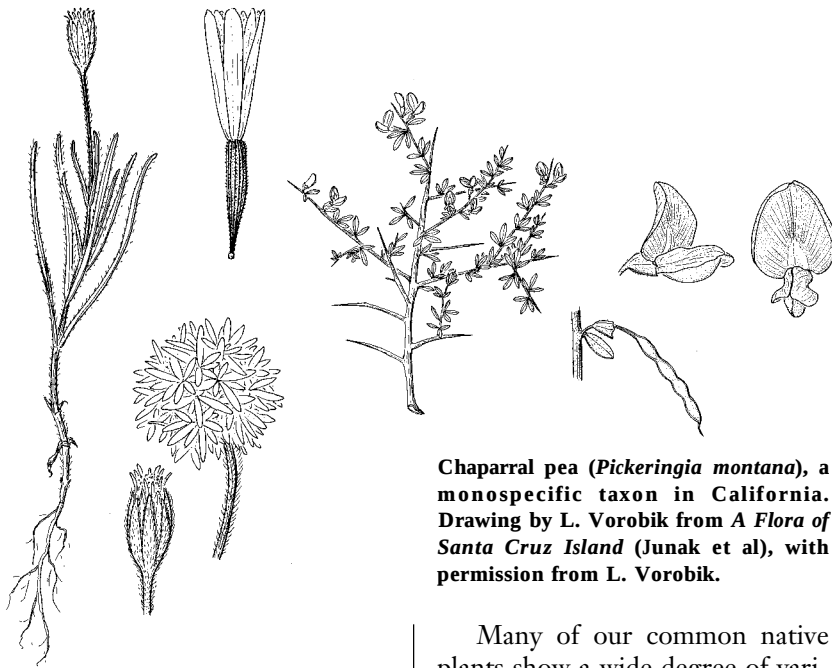
tion the generic circumscription of these plants.

Similar to the situation with monospecific taxa is the case of plants that are the only native representative of a particular genus in our native flora. There is, however, an additional caveat, as these plants may hybridize with their non-native congeners. California native plants in this category include: *Amsonia tomentosa*, *Aralia californica*, *Aristolochia californica*, *Calocedrus decurrens*, *Calycanthus occidentalis*, *Cephalanthus occidentalis* var. *californicus*, *Corylus cornuta* var. *californica*, *Heracleum lanatum*, *Justicia californica*, *Ptelea crenulata*, *Pycnanthemum californicum*, *Staphylea bolanderi*, and *Torreya californica*.

Some of our rare native plants

SOME WIDESPREAD, MONOSPECIFIC TAXA OF CALIFORNIA

SCIENTIFIC NAME	COMMON NAME
<i>Achyrochaena mollis</i>	Blow wives
<i>Anisocoma acaulis</i>	Anisocoma
<i>Anemopsis californica</i>	Lizard tail
<i>Bergerocactus emoryi</i>	Golden cereus
<i>Chamaebatiaria millefolium</i>	Fern bush
<i>Chilopsis linearis</i>	Desert willow
<i>Cneoridium dumosum</i>	Bushrue
<i>Coleogyne ramosissima</i>	Black brush
<i>Darmera peltata</i>	Indian rhubarb
<i>Fallugia paradoxa</i>	Apache plume
<i>Hesperocallis undulata</i>	Desert lily
<i>Heteromeles arbutifolia</i>	Toyon
<i>Leucocrinum montanum</i>	Sand lily
<i>Malosma laurina</i>	Laurel sumac
<i>Oemleria cerasiformis</i>	Indian plum
<i>Olneya tesota</i>	Ironwood
<i>Pickeringia montana</i>	Chaparral pea
<i>Salazaria mexicana</i>	Paper-bag bush, bladder sage
<i>Sequoia sempervirens</i>	Coast redwood
<i>Sequoiadendron giganteum</i>	Giant sequoia
<i>Sphenosciadium capitellatum</i>	Ranger's buttons
<i>Tellima grandiflora</i>	Fringe cups
<i>Tolmiea menziesii</i>	Pig-a-back plant
<i>Umbellularia californica</i>	California laurel
<i>Venegasia carpesioides</i>	Canyon sunflower



Chaparral pea (*Pickeringia montana*), a monospecific taxon in California. Drawing by L. Vorobik from *A Flora of Santa Cruz Island* (Junak et al), with permission from L. Vorobik.

Blow-wives (*Achyrachaena mollis*), a monotypic genus in California. Drawing by L. Vorobik from *A Flora of Santa Cruz Island* (Junak et al), with permission from L. Vorobik.

are not closely related to any other native plants and are found in specific geographic areas of the state. The use of these natives is not a genetics concern unless they are planted in or near their wild populations. In all cases, the garden or landscape use of these plants near or adjacent to wild populations should be restricted to plants derived from local origin. There are many examples of this condition in our flora. *Lyonothamnus floribundus* ssp. *floribundus*, *Lyonothamnus floribundus* ssp. *asplenifolius*, and *Galvezia speciosa* are native to the California Channel Islands and can be used anywhere on the California mainland without fear that they will genetically interact with any other native plant or with the wild populations. Similarly, the use of *Dirca occidentalis* would not present a genetics problem if it were planted outside of the San Francisco Bay Area counties where it naturally occurs. *Neviusia cliftonii* is only known from Shasta County, though it may be grown without the possibility of adverse genetic consequences throughout the rest of the state.

Many of our common native plants show a wide degree of variability through a portion of their natural distribution or throughout their native range. Plants that would fall into this category include *Heteromeles arbutifolia*, *Rhamnus californica*, *Eriogonum umbellatum*, and *Pinus sabiniana*. In these situations, the best alternative is to use plants of local origin.

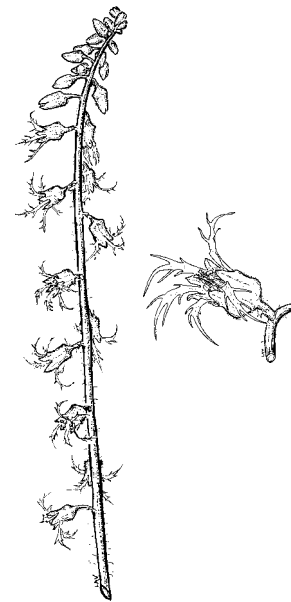
HYBRIDIZATION

Hybrid plants are created by the sexual or genetically engineered interaction of two different plant genera, species, subspecies, or varieties. The number of hybrids that are produced in a given area is dependent upon a number of variables. Chief among these variables are the following: 1) the more closely related that the two plants are, the more likely they are to produce hybrids; and 2) fertile pollen must reach a receptive stigma, therefore periods of flowering must overlap and an appropriate vehicle for movement of pollen to stigma must exist. Hybrids are frequently produced both in the wild and in the garden.

Examples of spontaneous hybrids found in the wild include the following: *Arctostaphylos media* (*A. columbiana* × *A. uva-ursi*), *Ceanothus mendocinensis* (*C. thyrsiflorus* × *C.*

velutinus var. *hookeri*), *Penstemon parishii* (*P. centranthifolius* × *P. spectabilis*), ×*Pachgerocereus orcuttii* (*Bergerocactus emoryi* × *Pachycereus pringlei*), *Elymus multisetus* × *Pseudoroegneria spicata*, and *Tellima grandiflora* × *Tolmiea menziesii*. Several cultivars of our native flora are hybrids of wild origin: *Arctostaphylos* 'Sunset', *Ceanothus* 'Coronado', *Encelia* 'Cadiz Reveille', *Erigeron* 'W. R.', *Iris* 'Valley Banner', *Lewisia* 'Margaret Williams', *Rhododendron* 'Oregon Queen', *Ribes* 'Pseudosanguineum', and *Sedum* 'Silver Moon'.

Examples of spontaneous hybrids that have occurred in gardens include: *Eriogonum blissianum* (*E. arborescens* × *E. giganteum*), *Garrya issaquahensis* (*G. elliptica* × *G. fremontii*), *Penstemon bryantae* (*P. palmeri* × *P. spectabilis*), and ×*Cupressocyparis leylandii* (*Cupressus macrocarpa* × *Chamaecyparis nootkatensis*). Many of the cultivars of California native plants are also chance hybrids of garden origin: *Arctostaphylos* 'Canyon Blush', *Ceanothus* 'Ray Hartman', *Heuchera* 'Lillian's Pink', *Romneya* 'White Cloud', and *Salvia* 'Allen Chickering'.



Fringe-cups (*Tellima grandiflora*) and pig-a-back plant (*Tolmiea menziesii*) will spontaneously hybridize to this intermediate form. Drawing by L. Vorobik.



Catalina ironwood (*Lyonothamnus floribundus* ssp. *asplenifolius*) leaf. This species is native only to the California Channel Islands, but is photographed here from the Rancho Santa Ana Botanic Garden, Claremont. Photograph by L. Vorobik.

Certain genera appear to be more prone to producing hybrids. In addition to those genera listed above, the following have been known to produce hybrids: *Aquilegia*, *Aster*, *Baccharis*, *Cercidium*, *Cercocarpus*, *Cornus*, *Delphinium*, *Dicentra*, *Dichelostemma*, *Fragaria*, *Fremontodendron*, *Fritillaria*, *Helianthus*, *Juglans*, *Keckiella*, *Lilium*, *Lupinus*, *Berberis* (*Mahonia*), *Mimulus*, *Opuntia*, *Philadelphus*, *Pinus*, *Platanus*, *Populus*, *Prunus*,

Quercus, *Rhododendron*, *Rhus*, *Rosa*, *Rubus*, *Salix*, *Sidalcea*, *Silene*, *Spiraea*, *Symphoricarpos*, *Triteleia*, *Vitis*, and *Zauschneria* (*Epilobium*).

Hybridization between Natives and Exotics

Native plants will frequently produce hybrids with closely related exotic plants. Quite a number of such cases are well documented. *Heuchera sanguinea* (from Arizona) has hybridized with the following natives: *H. elegans*, *H. hirsutissima*, *H. maxima*, *H. pilosissima*, and *H. merriamii* (*pringlei*). Two exotics, *Ceanothus americanus* and *C. ovatus*, have been hybridized with Californian *Ceanothus*.

Recent studies (by Arias, 1994) have shown that cultivated plants genetically interact with their wild counterparts. Dr. Arias set up replicates of an ingenious experiment where wild types of sunflowers (*Helianthus annuus*) were planted at intervals ranging from 3 meters to 1,000 meters from an agricultural planting of a cultivar of *Helianthus annuus*. Subsequent laboratory analysis of harvested seedheads conclusively demonstrated that nearly all of the plants showed evidence of

gene flow. The amount of this interaction varied with distance, but even those plants at the furthest distance showed a rate of up to 2% hybrid origin. The highest rate of hybridization recorded in this study was 27%, and the overall average was 10%. Other examples of crop plants hybridizing with their wild cousins that are cited by Dr. Arias include *Cucurbita*, *Raphanus*, and *Oryza*. In a 1994 conversation, Dr. Arias stated that there would be ample opportunity for gene flow between the shrubby *Mimulus* (*Diplacus*) growing at Rancho Santa Ana Botanic Garden and those growing in the nearby foothills of the San Gabriel Mountains (a distance of four miles).

A number of other economically significant exotic plants have also been shown to hybridize with their Californian counterparts. The Persian or English walnut (*Juglans regia*) will cross with both California native walnuts *Juglans californica* var. *hindsii* and *Juglans californica* var. *californica*. One of the resulting plants, *Juglans* 'Paradox' is now one of the principal rootstocks for the walnut industry in California.

Other known cases of hybridization between native and exotic species of the same genus include the following: *Agave*, *Alnus*, *Aquilegia*, *Aster*, *Calliandra*, *Cassiope*, *Ceanothus*, *Cornus*, *Dicentra*, *Erigeron*, *Fragaria*, *Fraxinus*, *Gaultheria*, *Iris*, *Philadelphus*, *Platanus*, *Populus*, *Rhododendron*, *Ribes*, *Rosa*, *Rubus*, *Sidalcea*, *Spiraea*, *Symphoricarpos*, and *Vitis*.

NATIVE WEEDS

When one thinks of the weed flora of California, few consider that some of our native plants do fall into the weed category. A few of our best native plant horticultural subjects, particularly when grown beyond their native range, can become serious weeds. The best



Columbine hybrid between *Aquilegia formosa* and *A. pubescens* from Little Lakes Valley. Shows form of *A. pubescens* but color of *A. formosa*. Photograph by L. Vorobik.

known of these is *Lupinus arboreus* along the north coast in Mendocino and Humboldt counties where it has escaped and is outcompeting the native coastal plants. Two of our native irises, *Iris douglasiana* and *Iris missouriensis*, have been categorized as noxious weeds in pastureland. Due to their bitter-tasting foliage, they are able to thrive and prosper in heavily grazed habitats. The now ubiquitous pop weed (*Cardamine oligosperma*) is a relatively recent native addition to the weed flora of gardens throughout the California floristic province. And, lest we forget, some of our native plants have become unwelcome pests in other Mediterranean climates of the world. Even our beautiful state flower, the California poppy (*Eschscholzia californica*), is a pest in Spain, Portugal, Italy, and Australia.

WILDLIFE

Some plants have well documented species specific associations. The distribution of the pipevine



Flower of California pipevine (*Aristolochia californica*), from UC Botanical Garden, Berkeley. Photograph by L. Vorobik.

swallowtail butterfly (*Battus philenor*) is restricted in California by the distribution of *Aristolochia californica*, its larval food plant. By planting this *Aristolochia* in other areas where it is not currently found, will this have an impact on the distribution of the butterfly?

Some of our native butterflies are equally adept at using exotic plants in the same plant family as their larval food plant. The anise swallowtail (*Papilio zelicaon*) uses exotic host plants *Foeniculum vulgare* (Fennel) and *Citrus* spp. apparently as successfully as its native larval hosts, *Tauschia arguta*, *Lomatium dasy carpum*, *Lomatium utriculatum*, and *Oenanthе sarmentosa*.

The El Segundo Blue Butterfly and Problems with “Native” Buckwheats

The El Segundo blue butterfly (*Euphilotes bernardino* ssp. *allyni*) is a federally listed endangered species inhabiting the coastal dune habitats of Los Angeles County between the Los Angeles International Airport and the Palos Verdes peninsula. The survival of this butterfly is entirely dependent upon the inflorescences of the coast buckwheat (*Eriogonum parvifolium*). The flowerheads are the butterfly’s site for everything from egg laying to mating. The only part of the butterfly’s life cycle that is not spent in or on the inflorescence is the time it spends as a pupae buried in the soil beneath the *Eriogonum parvifolium* plant.

Very little habitat remains for this butterfly. In the mid 1970s, a portion of this vital habitat was graded and hydroseeded with a mix of what were thought to be appropriate California native plant species. This seed mix included the California buckwheat (*Eriogonum fasciculatum*), and it quickly established itself at the site. Researchers monitoring the site found that the butterfly population significantly

decreased and began to investigate the causes for the decline. Their findings were quite startling—they found that the inflorescences of *Eriogonum fasciculatum* and those of *E. cinereum* were poisonous to the larvae of the El Segundo blue butterfly.

They also found that the presence of *Eriogonum fasciculatum* was favoring two native moths (*Lorita scarifica* and *Aroga* sp.) at the expense of the butterfly. These two moth species are capable of producing more than one generation each year, but the El Segundo blue butterfly is limited to a single generation per year. The moths utilized the inflorescences of both species of buckwheats as larval food plants, and since *Eriogonum fasciculatum* came into bloom about a month before *E. parvifolium* at this site, the moths gained a competitive advantage over the butterfly. The increased population of moths also raised the populations of parasitoides in the area that did not significantly differentiate between the larvae of the moths and the butterfly. Fortunately, the Los Angeles International Airport Commission provided emergency funds to eliminate *Eriogonum fasciculatum* from the area.

CONCLUSION

Plants are notoriously difficult subjects to generalize about. Even most of the case studies sited in this article are still in need of further investigation and study. The California flora will survive. The question is, what will the flora look like 10,000 years from now, and how will our horticultural and conservation activities affect the future of the diversity of California’s native flora?

Bart C. O’Brien, Rancho Santa Ana Botanic Garden, 1500 N. College Avenue, Claremont, CA 91711

GROWING LISTED PLANTS UNDER FEDERAL LAW

by Jim A. Bartel

Unlike the protections provided to federally listed wildlife or fauna, Federal law does not necessarily prohibit the growing of listed plants. In fact, only under certain circumstances does Federal law affect the collection of seeds or cuttings and the cultivation of listed plants.

ENDANGERED SPECIES ACT OF 1973

Within the definition of “take” under section 3 of the Endangered Species Act (ESA) of 1973, as amended, it is unlawful, among other things, to pursue, capture, or collect listed wildlife. As such, scientific research permits under section 10 of the ESA are required to engage in activities that may take wildlife regardless of whether the activity occurs on Federal government land. Unfortunately, plant protection under the ESA is limited by comparison.

Section 9 of the ESA and its implementing regulations (50 CFR Section (§) 17.61 for endangered plants; and 50 CFR § 17.71 for threatened plants) provide a series of general prohibitions and exceptions that apply to all listed plants. These prohibitions, in part, make it illegal for any person—subject to the jurisdiction of the United States—to: 1) import or export, transport in interstate or foreign commerce in the course of a commercial activity; 2) sell or offer for sale in interstate or foreign commerce; or 3) remove and reduce to possession any listed plant from areas under Federal jurisdiction. Seeds from cultivated specimens of threatened plants are exempt from these prohibitions provided that their containers are marked

“Of Cultivated Origin.” The phrase “remove and reduce to possession” has been interpreted to mean the removal of a listed plant from its location that is held by a person as his or her own.

In 1988, the ESA was amended to prohibit the malicious damage or destruction of endangered plants in areas under Federal jurisdiction and the removal, cutting, digging

up, damaging, or destroying of such plants in known violation of any State law or regulation, or in the course of any violation of a State criminal trespass law. This endangered plant provision was intended to stop “willful acts of vandalism” and not inhibit otherwise lawful



Lemon lily (*Lilium parryi*), locally extirpated from portions of its range, and threatened by horticultural collecting. Drawing by L. Vorobik from the *CNPS Inventory of Rare and Endangered Plants*, 5th and 6th Editions.

permitted land use operations (e.g., mining, logging). Section 4 of the ESA allows for such protection to be granted to threatened species via future regulation.

The ESA and its implementing regulations (50 CFR § 17.62 and § 17.63 for endangered plants; and 50 CFR § 17.72 for threatened plants) also provide for the issuance of scientific research permits to carry out otherwise prohibited activities involving listed plants under certain circumstances. For threatened plants, permits are also available for botanical or horticultural exhibition, educational purposes, or special purposes consistent with the purposes of the ESA.

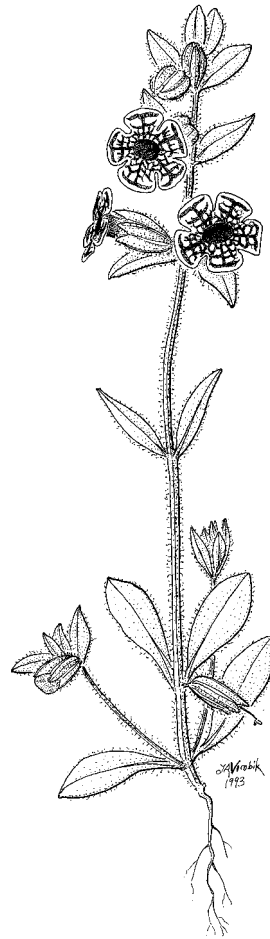
LACEY ACT AMENDMENTS OF 1981

The Lacey Act, as amended in 1981, provides limited protection for listed plants beyond that provided by the ESA and its implementing regulations. Under this statute, it is unlawful to import, export, sell, receive, acquire, purchase, or engage in the interstate or foreign commerce of any plant taken, possessed, or sold in violation of any law, treaty, or regulation of the United States, any Indian tribal law, or any law or regulation of any State. In short regarding the cultivation of listed plants, the Lacey Act makes it illegal to grow (i.e., possess) listed

plants (including seeds) that were taken illegally and commercially transported across State lines or into the United States.

POLICY

On September 20, 2000, the US Fish and Wildlife Service and National Marine Fisheries Service (the Services) jointly published a final policy on the role of controlled propagation in the recovery of listed species under the ESA (Federal Register 65:56916-56922). This policy supports and promotes coordination between various phases of controlled propagation efforts such as propagation technology development, propagation for release, population augmentation, reintroduction, and monitoring. This policy will also contribute to the efficient use of funding resources. The Services assert that controlled propagation is not a substitute for addressing the decline of an endangered or threatened species. As a result, the first priority of the Services is to recover wild populations in their natural habitat wherever possible, without resorting to the use of controlled propagation. Though this policy does not necessarily further restrict the cultivation of federally listed plants, it requires that scientific research permits under the ESA comply with the policy.



Calico monkeyflower (*Mimulus pictus*), is threatened by grazing in the wild, but has been successfully grown from seed. Drawing by L. Vorobik from the CNPS *Inventory of Rare and Endangered Plants*, 5th and 6th Editions.

SUMMARY

Most cultivation of listed plants is little affected by the limited provisions of Federal law and joint policy of the US Fish and Wildlife Service and National Marine Fisheries Service. The Endangered Species Act and Lacey Act likely do not prohibit the growing of federally listed plants except for: 1) collection from Federal land, in known violation of any State law or regulation (including State criminal trespass law), or 2) in violation of any Federal, State, or Indian tribal law where plant material was commercially transported across State lines or into the United States.

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WEB PAGE RESOURCES

See the CNPS web site (Home Page at www.cnps.org) for more information about:

Endangered Species—Internet Links. *From Home Page select “Links,” then “Endangered Species Act Issues.”*

Endangered Species Acts (ESA & CESA). *From Home Page select “Conservation,” then “ESA.”*

Conservation Policies (including sowing wildflowers, transplanting, and collecting). *From Home Page select “Policy Archive,” then scroll down to “Conservation Policies” under “Policies and Guidelines.”*

NATIVE PLANT HORTICULTURE RESOURCES: A STARTING POINT FOR NATIVE PLANT GARDENING

Sue Rosenthal and friends

[Editor's note: These lists were started by Sue Rosenthal from the resources available at the Regional Parks Botanic Garden, Berkeley, and added to by numerous contributors. Special thanks go to Jeanne Ateljevich, editor of *Manzanita*, journal of the Friends of the Regional Parks Botanic Garden, for several of the web page addresses. The resources here are presented as a starting point for learning more about native plant horticulture, and are not necessarily endorsed by CNPS. Another excellent source of "native-to-site" plants and seeds is from local CNPS Chapter plant sales.]

NURSERIES THAT CARRY NATIVE PLANTS

California Flora Nursery, Fulton, 707-528-8813
Circuit Rider Productions (call for appointment), Windsor, 707-838-6641
Consentinis Nursery, Malibu, 310-456-6026
ConservaSeed (grasses), Rio Vista, 916-775-1676
Cornflower Farms, Elk Grove, 916-689-1015
El Natio Growers, Inc., Azusa, 626-969-8449
Elkhorn Native Plant Nursery, Moss Landing, 831-763-1207
Far West Bulb Farm, Grass Valley, 530-272-4775
Floral Native Nursery, Chico, 530-892-2511
Freshwater Farms, Eureka, 707-444-8261
Hedgerow Farms (grasses), Winters, 530-662-6847
Intermountain Nursery, Prather, 559-855-3113
Las Pilitas Nursery, Santa Margarita, 805-438-5992
Matilija Nursery, Moorpark, 805-523-8604
Mockingbird Nursery, Riverside, 909-780-3571
Mostly Natives Nursery, Tomales, 707-878-2009
Native Here (East Bay natives only), Berkeley, 510-549-0211
Native Revival, Aptos, 831-684-1811
Native Sons Nursery (wholesale only), Arroyo Grande, 805-481-5996
North Coast Native Nursery, Petaluma, 707-769-1213
Rancho Santa Ana Botanic Garden (Nov.-May only), Claremont, 909-625-8767
Santa Barbara Botanic Garden, Santa Barbara, 805-682-4726

SLUG Native Plant Nursery, Log Cabin Ranch, 650-747-9606

Suncrest Nurseries (wholesale), Watsonville, 831-728-2595

Theodore Payne Foundation, Sun Valley, 818-768-1802

Tree of Life Nursery, San Juan Capistrano, 949-728-0685

Yerba Buena Nursery, Woodside, 650-851-1668

Wayward Gardens, Sebastopol, 707-829-8225

SEED SOURCES:

Albright Seed Company, Martinez, 925-372-8245

Clyde Robin Seed Company, Castro Valley, 510-785-0425

ConservaSeed (grasses), Rio Vista, 916-775-1676

Hedgerow Farms (grasses), Winters, 530-662-6847

Larner Seeds, Bolinas, 415-868-9407

Pacific Coast Seed, Livermore, 925-373-4417

S & S Seeds, Carpinteria, 805-684-0436

Theodore Payne Foundation, Sun Valley, 818-768-1802

HORTICULTURE BOOKS

Emery, Dara E., 1988. *Seed Propagation of Native California Plants*. Santa Barbara Botanic Garden, 115 pp.

Lenz, Lee W. and John Dourley, 1981. *California Native Trees and Shrubs for Garden and Environmental use in Southern California and Adjacent Areas*.

Claremont: Rancho Santa Ana Botanic Garden, 232 pp. (out of print)

Lowry, Judith. 1999. *Gardening with a Wild Heart*. University of California Press. See review this issue p. 37.

O'Brien, Bart C., Lorrae C. Fuentes, and Lydia F. Newcombe (editors). Rancho Santa Ana Botanic Garden Occasional Publications #1 (June 1997). Symposium Proceedings. *Out of the Wild and into the Garden I. California's Horticulturally Significant Plants*. April 30-May 2, 1992. 212 pages. 21 papers.

O'Brien, Bart C., Lorrae C. Fuentes, and Lydia F. Newcombe (editors). Rancho Santa Ana Botanic Garden Occasional Publications #2 (June 1997). Symposium Proceedings. *Out of the Wild and into the Garden II. California's Horticulturally Significant Plants*. March 9-11, 1995. 261 pages. 21 papers.

O'Brien, Bart C., Lorrae C. Fuentes and Lydia F. Newcombe (editors). Rancho Santa Ana Botanic Garden Occasional Publications #3 (March 1999). Symposium Proceedings. *Out of the Wild and into the Garden III. California's Horticulturally Significant Plants*. June 19-21, 1997. 133 pages.

O'Brien, Bart C. 1999. *California Native Plant Gardens: Care and Maintenance*. Rancho Santa Ana Botanic Garden. 16 pages.

Schmidt, Marjorie G., 1980. *Growing California Native Plants*. Berkeley, University of California Press, 366 pp.

Stevens, Barbara & Nancy Conner. 1997. *Where on Earth—A Guide to Specialty Nurseries and Other Resources for California Gardeners*. Heydey Books, Berkeley. 3rd Edition.

WEB SITES

Botanical Gardens and Arboreta:

Friends of the Regional Parks Botanic Garden (Tilden):
www.nativeplants.org

Rancho Santa Ana Botanic Garden:
www.cgu.edu/inst/rsa

Santa Barbara Botanic Garden: www.sbbg.org

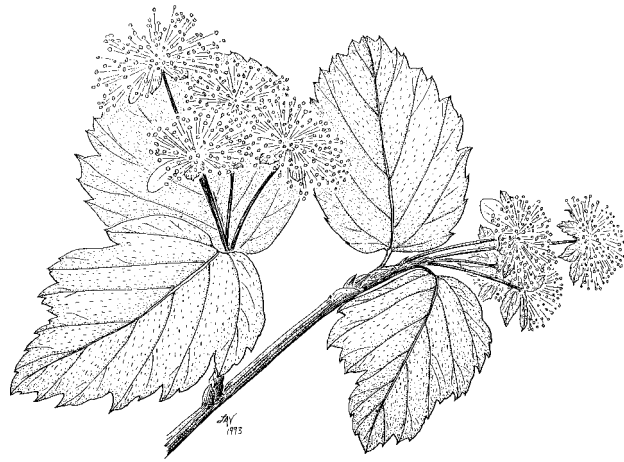
Strybing Arboretum: www.strybing.org

University of California at Berkeley Botanical Garden:
www.mip.berkeley.edu/garden

University of California at Davis Arboretum:
www.arboretum.ucdavis.edu

Native Plant Societies:

CNPS web site: www.cnps.org (see sidebar, p. 25)



Shasta snow wreath, *Neviusia cliftonii*. Drawing by L. Vorobik from the CNPS Inventory of Rare and Endangered Plants, 5th and 6th Editions.

"Gardening and Landscaping" section of Oregon Native Plant Society web page:

www.npsoregon.org/pos/gard.htm

Native plant gardening from the Washington Native Plant Society: www.wnps.org/gardening.html

Noxious weeds (what not to grow!):

www.aphis.usda.gov/ppq/weeds

www.pwrc.usgs.gov/wlinews/sprsum99.htm

www.pi.cdffa.ca.gov/weedinfo/

www.caleppc.org

Nurseries:

Use web page search engine and search on nursery names (above) in quotes

Miscellaneous:

Botanical books: huntbot.andrew.cmu.edu/CBHL/CBHL-Libraries.html

California native plants discussion group:
www.calypteanna.com/ca-natives.htm

CalFlora Database: www.calflora.org

California Wildflower and Fall Color Hotsheet:
www.calphoto.com

Pacific Coast Iris Society: www.pacificcoastiris.org

Resources for San Francisco Bay Area gardeners:
www.gardens.com

Seed-banking: www.berrybot.org/ar_ssfuture.html

Sudden oak death: www.suddenoakdeath.org

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INDEX TO *FREMONTIA*: GROWING CALIFORNIA NATIVE PLANTS VOLUMES 1–28, APRIL 1973–JANUARY 2000

Compiled by Vivian Parker

When searching for a specific plant, look for both the scientific and common names, as all plants are not listed both ways. Note that some names have changed since the first *Fremontia* was published in April 1973. If you are looking for a specific plant, be sure to check for synonyms also.

Annuals. 5(1):8-13; Apr 77.

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Bibliography, gardening with natives. 13(1):25-28; Apr 85.

Big-leaf maple (*Acer macrophyllum*). 8(4):23-24; Jan 81.

Bleeding heart (*Dicentra formosa*). 9(1):30; Apr 81.

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Bleeding heart (*Dicentra formosa*). Illustrations on pp. 28 and 29 by Margaret Warriner Buck, from *The Wild Flowers of California* by Mary Elizabeth Parsons.

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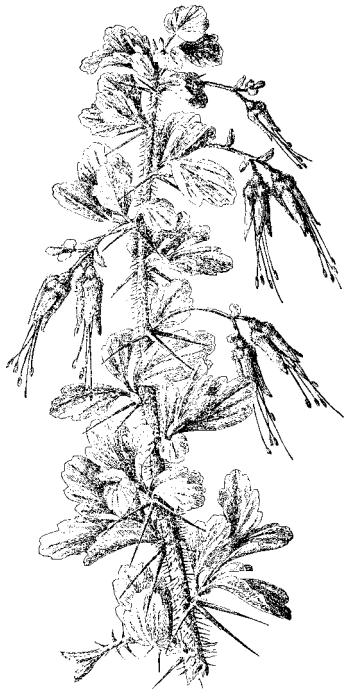
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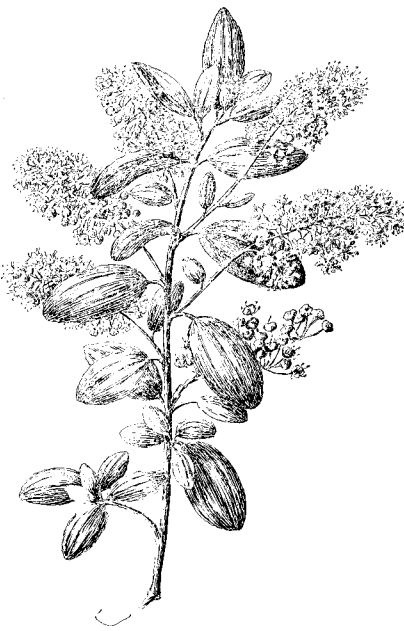
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Vivian Parker, 6221 Shoo Fly Rd., Kelsey, CA 95667

NATIVES FOR YOUR GARDEN

by Marjorie G. Schmidt

[Reprinted from *Fremontia*, Vol. 2:4, January 1975.]

GOLDEN LANTERN

(*Calochortus amabilis*)

Family: Lily (Liliaceae)

Other Names: Golden lily-bell, yellow fairy lantern

Habit: A stout plant, six inches to two feet tall, growing from a solid, coated bulb. The stem is erect or curved and is branched.

Foliage: The basal leaf is lance-shaped, of a glossy, dark green. It is often longer than the stem. On the stem are cauline leaves and long, pointed leaf-like bracts.

Flowers: The flowers are nodding, triangular globes of overlapping petals of a deep, clear yellow. The edges of the petals are incised, making a delicate fringe. The gland appears as a blister on the outside of the petal. The greenish-yellow sepals are long and pointed. Blooming time is May or June.

Fruit. The fruits are nodding, three-winged capsules containing ample dark brown seed.

Culture: The golden lantern may be grown from seed; it takes

about three years to produce a flowering bulb. Plant seeds in pots or deep boxes in a friable soil-mix containing coarse sand and oak humus, or peat moss if the leaf mold is not available. Seedling bulblets are small white ovals, which may be transplanted to fresh soil after the second year or allowed to remain in the original container until mature. In the garden, plant the bulbs three or four inches deep in well-drained soil, in either full sun or high, broken shade. If gophers are present, protect the bulbs by planting them in a shallow, oblong wire-mesh basket. Golden lantern is especially suitable for pockets in the rock garden, a raised border, or a sunny spot in front of shrubs or perennials, but should not be closely crowded by other plants. It will tolerate moderate amounts of water during the growing season. Golden lantern has not persisted in my mountain garden at 3000 feet elevation.

Estimate of Garden Value: In my opinion this is one of the gems among our wide range of bulbous plants, with the bearing and fine proportions of an aristocrat. Although I have not found the golden lantern to be quite so adaptable as *Calochortus albus*, it is known to be amenable to cultivation, given the correct situation, soil, and good drainage. For a companion, the gardener might consider *Iris macrosiphon*, a natural combination occurring occasionally in the wooded foothills and one I always planned to copy but never quite achieved. Other suitable companions might be one of the low, shrubby-based penstemons, such as *Penstemon parvulus* or *P. heterophyllus* ssp. *purdyi*, although their flowering periods might not always coincide. Other native bulbs likely to bloom at the same time and to afford a



Iris macrosiphon from Tiburon ridge. Photograph by S. McCormick; its use courtesy of the Jepson Herbarium, UC.

charming contrast would be *Brodiaea bridgesii* and *B. terrestris*. Closely related to golden lantern is *Calochortus pulchellus*, local to Mt. Diablo, its flowers having thick hairs on the inner face and slightly more conspicuous fringing on the petals.

Distribution: Golden lantern grows on loamy to rocky soils, on dry, brushy slopes, or in woodlands in the North Coast Ranges from Marin to Humboldt Counties. West of Red Bluff, scattered colonies appear among upland groves of *Quercus lobata* and *Q. douglasii*, along with a wide assortment of typical foothill natives. Here, in garden-like grassy dells, it is preceded by glowing masses of shooting stars (*Dodecatheon* spp.) and followed by the lobster-red blossoms of *Silene californica*.



Figure: Golden lantern (*Calochortus amabilis*). Photo credit unknown; its use courtesy of the Jepson Herbarium, UC.

WHITE GLOBE-LILY

(*Calochortus albus*)

Family: Lily (*Liliaceae*)

Other Names: Fairy lantern, pearly globe

Habit: A stout plant growing from a small, solid, oval bulb having a thin coat.

Foliage: The leaves are basal, elongated, lanceolate, and a glossy, deep green. There are narrow leaves along the stem and leaf-like bracts.

Flowers: The nodding, nearly globe-shaped flowers have three petals which curve in to meet at the tips. They are a satiny white, sometimes faintly rose tinted. Short sepals, often with rose or purplish tint, curve around the globe. A gland on the inner petal causes a raised, blister-like appearance on the outside of the flower.

Fruit: The fruit is a nodding, three-sectioned capsule, quite conspicuous and containing generous quantities of black, angular seeds.

Culture: White globe-lily is one of the most adaptable of the calochortus, accepting the conditions of a watered, shady border. Seed may be planted with no pretreatment in a friable, humus soil in autumn, using deep pots, boxes, or a well-protected outdoor bed. Bulbs will be mature and ready to flower in about three years, and until then, only a narrow, spear-like leaf will appear each spring. When ready to



Iris innominata from Rancho Santa Ana Botanic Garden. Photo credit unknown; its use courtesy of the Jepson Herbarium, UC.

flower, the long basal leaf will spring up first, followed by the flowering stalk, the latter generally sparingly branched and bearing one or more flowers. In moist woodlands, plants are exceptionally tall and robust with an abundance of flowers. In dry oak woodlands, plants tend to be smaller with few side branches. White globe-lily is hardy to cold and has flourished in my present mountain garden.

Estimate of Garden Value:

There is no question of the adaptability, beauty, and worthiness of this lovely flower. In my experience plants persist for many years, and seem not at all subject to the diseases and other problems which beset the tall mariposas. Plants have a graceful bearing, and the flowers have a translucent, lustrous quality often noted by admirers of the genus. It was beloved of John Muir,

who considered it without peer among wildflowers. In a shady border it may be used with vancouveria, *Iris innominata*, and such garden subjects as violets, primroses, columbines, any of the many low, trailing campanulas, and ferns. It is also suitable for a semi-shady rock garden, a north slope, and in company with other small native bulbs. It blooms in May and June.

Distribution: White globe-lily is found on wooded slopes and canyons in the western foothills of the Sierra and Butte County southward to Madera County; in the Coast Ranges south to Los Angeles County; and in the San Gabriel and Cuyamaca Mountains. It grows to great height and perfection in many places in the Santa Cruz Mountains.

Marjorie G. Schmidt, 1905-1989



White globe-lily (*Calochortus albus*) from Santa Cruz Island. Photograph by D. Wilken.

GROWING COAST REDWOOD AND GIANT SEQUOIA

Lori Hubbart

COAST REDWOOD (*SEQUOIA* *SEMPERVIRENS*)

Seed

Coast Redwood seeds are very small, and are collected from the cones in early to mid-fall. Wild-collected seed will have a poor germination rate due to the low percentage of viable seeds. Commercial seed has been air-blown to winnow out the lighter, non-viable seeds. This is what gives commercial redwood seeds their higher germination percentage. However, when growing for restoration purposes, it is best to use site-specific seeds, or as close to it as possible. Unless you want to experiment with winnowing techniques to eliminate the non-viable seeds, you must collect more seed than you need to insure sufficient germination for your purposes.

No special treatment of the seeds is needed, although Emery's *Seed Propagation of Native California Plants* notes that one-month cold stratification may improve germination. If sowing in one-gallon pots, 10 seeds per pot is a good number. A gritty, well-drained mix is essential.

Cuttings

As one would expect, coast redwood's readiness to grow and regrow after logging or natural disasters makes it quite amenable to propagation from cuttings. Redwood cuttings from side shoots may not develop the strong central stem, or "leader" necessary for its future life as a tall, straight conifer. To avoid this difficulty, always take cut-

tings from a main (apical) branch tip, rather than side (lateral) shoots.

High success rates are achieved using no synthetic rooting hormone. This is good news, since there are safety concerns associated with IBA (indolebutyric acid) in strong concentrations. A powder-based re-

tail product, such as Rootone, may be used if non-treated cuttings fail to root.

The ends of the cuttings are dipped in the rooting hormone, and then stuck into a medium held in a container. The cutting medium should be something gritty

Old growth coast redwood (*Sequoia sempervirens*). Photograph by A. Schoenherr.



and sterile, such as coarse sand, perlite, or a mixture of perlite and vermiculite. Perlite is a white, lightweight mineral product. Vermiculite is actually flakes of air-puffed mica. These products must be watered first and handled with care to avoid breathing their dust. The containers can be placed on heating cables, which helps to stimulate root development.

Care of Young Trees

Commercial tree nurseries grow redwoods and other conifers in long, narrow tubes or bands. This provides for vertical root space, which is more important to a young tree than lush top growth. Lacking such containers, redwood seedlings can be grown in small pots and then moved up into gallon cans.

Redwoods in the wild grow with the aid of endomycorrhizal fungi, associated with the roots of the trees. These fungal associates are essential to the growth and health of redwoods and can be included in the potting soil. Commercial growers sometimes add a fungal inoculant, but the same results may be achieved by mixing in some of the soil around the base of wild redwoods.

Coast redwood trees grow naturally in damp canyons or fog belts, but can even be grown in hot, dry areas if given plentiful water. Although young trees grown anywhere need summer water, they do not require the high-nitrogen feeding regimen often given to conifers.

GROWING GIANT SEQUOIA (*SEQUOIADENDRON GIGANTEUM*)

Seed

The cones of giant sequoias are serotinous, or closed, and may remain so for 20 years with the viable seeds intact within. The cones must

be induced to open and release their seeds, which can be done by putting the cones in an oven on low temperature, and checking them frequently.

As with its cousin, the coast redwood, giant sequoia seeds have a low rate of viability. Cold stratification of seeds for 60 days may produce faster germination, but is unlikely to increase the percentage of seeds that germinate.

Use seed from newly opened cones, as seed viability period is short. In order to germinate and grow, seeds must have an adequate and regular supply of moisture and be protected from drying influences of air and light. Cover the seeds with 1/4" of seed medium. Note that while coast redwoods occur naturally in acidic soils, giant sequoia seeds germinate best with a neutral pH. The seed medium should have a high mineral, rather than organic content.

Cuttings

Young giant sequoias may produce stump sprouts as a result of injury, but do not typically resprout from stumps or roots. While giant sequoia cuttings may root without a rooting hormone, a low-strength rooting product may be helpful.

Cuttings are usually taken from trees under 30 years old, though cuttings from young (but hardened off) growth of older trees may be successful. As with many conifers, it may take six months or more for a cutting to produce roots.



Foliage and cones of coast redwood (left) and giant sequoia (right). Photograph by A. Schoenherr.



The Grizzly Giant, an old growth giant sequoia in Yosemite National Park. Photograph by A. Schoenherr.

Care of Young Trees

Young giant sequoia trees must have regular water, and they absolutely need plenty of sunlight to thrive. Many conifer species require shade when young, but this is not true of the giant sequoia.

Like coast redwood and many other forest trees, giant sequoias rely on endomycorrhizal fungi for healthy growth, so the same treatment is appropriate. It might be difficult, however, to obtain soil from around the dripline of mature giant sequoia trees. Further, these trees have sensitive feeder roots near the surface, which could be damaged by digging. The addition of the appropriate mycorrhizal inoculant might be best, and these products can probably be located on the Internet.

Lori Hubbard, P.O. Box 985, Point Arena, CA 95468

CALIFORNIA REDWOOD: WHAT IS THE STATE TREE?

by Allan A. Schoenherr

This is a story about names. I got started on this topic when it was pointed out to me by Bill Tweed, chief interpreter for Sequoia National Park, that coast redwood (*Sequoia sempervirens*) and giant sequoia or Sierra redwood (*Sequoiadendron giganteum*) are both considered the official California state tree.

This apparent conundrum was created by the California Legislature in 1937 when it designated California redwood the official state tree without specifying a scientific name. The matter was reinforced in 1951 when the California Attorney General formally declared that, without a scientific name, both trees were officially the state tree. Following this decision, a report was submitted to the California Legislature by the State Park Commission and the State Forester, in which they officially adopted the common names of coast redwood and Sierra redwood for the two trees. As of 1951, both trees were officially known as redwoods, according to the California Divisions of Forestry and State Parks and, according to most taxonomists, both trees also were in the genus *Sequoia*.

Calling either tree a redwood was not new in 1951. Erwin Gudde, in his 1969 publication *California Place Names*, notes that the name redwood is used for more than fifty localities along the coast and several others in Tulare and Fresno counties in the Sierra Nevada, the latter of which clearly refer to the Sierra redwood.

The genus name *Sequoia* apparently was applied to both of these California trees by an Austrian scholar, Stephan L. Endlicher, in his 1847 treatise *Synopsis Coniferarum*. At the time, the coast red-

wood was in the genus *Taxodium*, and the Sierra redwood was in the genus *Wellingtonia*. Doubtless Endlicher wished to honor Sequoyah, who developed a written version of the Cherokee language. He apparently applied both species names to the coast redwood, but in 1854, J. Decaisne, a French botanist, transferred the name *Sequoia gigantea* to the Sierra redwood. In honor of the giant trees of the Sierra Nevada, Sequoia National Park and Sequoia National Forest were established and named, the former in 1890 and the latter in 1908.

While explanation for the name *Sequoia* seems simple enough, the name *Sequoiadendron* went through a long period of controversy before it was accepted. It was proposed originally in 1939 by John Buchholz, a botany professor at the University of Illinois, but was not even provisionally accepted until the late 1950s. By 1953 Donald Culross Peattie, in *A Natural History of Western Trees*, still used the genus *Sequoia*, whereas Lyman Benson, in his 1957 book *Plant Classification*, and Philip Munz, in *A California Flora*, published in 1959, used *Sequoiadendron*.

I prefer calling the two species coast redwood and Sierra redwood, based on their close relationship, and am not alone in this opinion. Dan Axelrod, the well-known paleobotanist, called *Sequoiadendron* Sierra redwood as recently as 1986. Certainly, the California Attorney General made the two terms official with his 1951 decision. Nonetheless, the Sierra species has been called big tree, bigtree, or giant sequoia as far back as the early 1900s.

Clearly, both species are redwoods, and the name *Sequoiadendron* means sequoia tree, an apparent at-

tempt to signify a close relationship with the genus *Sequoia*. Why obfuscate the relationship between the two species by using a common name such as big tree or giant sequoia for the Sierra species when neither name calls attention to the relationship, and neither is a translation of the genus? True, Sierra redwoods are big or giant trees, but so are coast redwoods. Both species are champions in their own right: coast redwoods are the tallest trees in the world, and Sierra redwoods are the largest in mass.

Names are best when they tell you something, or somehow characterize an entity. Nevertheless, we can come up with thousands of common and scientific names that are meaningless outside local use. I don't believe that we can change a common name by decree—even if the change is an improvement—but attempts are being made to modify names such as Mormon tea, squaw bush, or digger pine because of the possible derogatory implications. Giant sequoia is widely used, and it relates to the name of a national park, a national forest, and a new national monument. It isn't likely the common name will be changed. These common names have become more permanent than scientific names. In my writing, however, I will qualify the common name of the Sierra Nevada species by saying "giant sequoia" or "Sierra redwood." Meanwhile, hooray for California for having two kinds of champion redwood, and so what if they are officially both the state tree? California is special for many reasons.

Allan A. Schoenherr, Fullerton College, Natural Sciences, 321 East Chapman Avenue, Fullerton, CA 92832-2095



The General Sherman Tree in Sequoia National Park. This Sierra sequoia (*Sequoiadendron giganteum*) is considered to be the largest living organism. Photograph by A. Schoenherr.

NOTES AND COMMENTS

Dear Editor,

Like Bruce Cowan (letters to *Fremontia*, Vol.28:2-4), I also have heard that G. Ledyard Stebbins introduced *Ehrharta erecta* to California (specifically to the UC Berkeley campus and adjacent nature preserves, where it is abundant and has ousted natives). And like Mr. Cowan, I originally assumed the story was true. Since the grass had no common name in California, I even christened it "Stebbin's Folly" (intentionally misspelling Stebbins's name to give it the imprecision that so often characterizes common names).

Years later, I met Dr. Stebbins and have heard his version. He was quite hurt that his name was associated, in his view unfairly, with *E. erecta*. According to Dr. Stebbins, the grass was common on campus, and had already spread up into Strawberry Canyon, when he first encountered it. He believed it was originally introduced "in P. B. Kennedy's time," i.e., through the campus Grass Garden (in existence in the early twentieth century), in which many species of grasses from Mediterranean-type climates were planted.

Dr. Stebbins did use colchicine to create *E. erecta* plants with double the normal number of chromosomes (artificial polyploids), and planted some

of these individuals in Strawberry Canyon. This was a scientific experiment, to test his hypothesis that simply doubling the genetic material would not make the plants better adapted. It probably is the source of the misimpression that he introduced the species. Dr. Stebbins and I examined the sites where he had planted the artificial polyploids, and he concluded that they were no longer present. Apparently, they had been outcompeted by normal *E. erecta* plants.

Although I believe Dr. Stebbins's version, I still like my common name of Stebbin's Folly. If Mr. Cowan is correct, Dr. Stebbins did help spread the plant to the Carmel area (though it would have dispersed there from the Bay Area eventually, regardless). But to me, my common name reminds us that we *all* are responsible for plant introductions. Any individual who has ever traveled outside the state, and then returned, has to some small degree endangered California's precious flora. In a global economy, introductions of invasive species can only continue.

This example also illustrates the very serious role that botanical gardens have played in introducing pest plants to foreign lands. Stebbin's Folly is only one of a number of grasses introduced through the Grass

Garden that has proven invasive. These include: 1) Chilean Brome (*Bromus stamineus*), which is very successful as a town weed, and which exhibits at least some limited ability to invade natural habitats. It so closely resembles some forms of California Brome (*B. carinatus*) that it is difficult to determine just how invasive it may be. 2) At least two Australian oatgrasses (*Danthonia* spp.), one of which is a major problem in north coastal California. The other is so successful as a Berkeley weed that it seems likely to become widespread eventually. 3) A Mediterranean wild oat (*Avena sterilis*), which has invaded natural areas in and around Berkeley. It also has hybridized with our common introduced wild oat (*A. fatua*), possibly further increasing the already extreme invasiveness of the latter. In addition, an introduced comp[osite] (*Urospermum picroides*), spreading slowly but surely and rising to dominance in appropriate East Bay habitats, probably came in originally as an "omni-Mediterranean" species in the Old World, and bids fair to become extremely successful in California in the long run.

Mark Blumer,
Assoc. Prof. of Geography,
State University of New York,
Binghamton

BOOKS RECEIVED

Flowering Vines, Beautiful Climbers, by Karen Davis-Cutler, guest editor. 1999. 111 pages. Though there is hardly any mention of native plants in this book, home gardeners will find it a convenient, concise source of information on flowering vines. There are chapters on the most popular blooming climbers, roses, and clematis, including outstanding cultivars, where to plant them, and how to care for them.

The book also has a guide for mail-order sources of flowering vines. This handbook is No. 158 in the Brooklyn Botanic Garden 21st Century Gar-

dening Series. Brooklyn Botanic Garden, 1000 Washington Ave., Brooklyn, NY 11225. \$9.95 softcover.

An Illustrated Flora of Yosemite National Park, by Stephen J. Botti. Illustrated by Walter Sydoriak. 2001. This 516-page 8.5-pound volume is illustrated with over 1,100 watercolor paintings and nearly 400 black-and-white line drawings (including those that illustrate the glossary).

"This is an impressive and beautiful flora for Yosemite National Park. All those who appreciate the park's natural treasures and botanical art in general will enjoy this book." —Peter H.

Raven, Missouri Botanical Garden
". . . a must-have book for anyone interested in the flora of Yosemite or surrounding areas. Its beautiful illustrations and efficient keys make for fast and reliable identifications." —Melanie Arnett, Botanical Consultant for 2001 Floristic Inventory, Devils Postpile National Monument

Letters from Yellowstone, by Diane Smith. 1999. Penguin Books. 226 pp. A delightful read that takes you back to the late 1800s; this novel describes the botanical adventures of fictitious scientist A. E. Bartram in Yellowstone National Park.

BOOK REVIEWS

Gardening with a Wild Heart, by Judith Lerner Lowry. 1999. 280 pages. 21 color photographs, 6 line illustrations. University of California Press, \$35.00 cloth, \$19.25 paper.

It's amazing. Fifty years ago the formation of CNPS was still only a gleam in the eyes of some Berkeley folks and Judith Lowry, the author of this exceptional book, had not even started school. At that young age Lowry had little interest in plants and might have been astonished to learn she was destined to write one of the major pace-setting garden books of the new millennium.

Times have certainly changed. Way back then a Bay Area friend of herbaceous border fame pointed to a new plant in her garden. "That," she said in hushed tones as if introducing me to the Dalai Lama himself, "is a California Native." Noticing my puzzled look she continued. "They're like olives, you know. They're an acquired taste." Unfortunately, like many other gardeners new to growing natives, her plant soon died from the lush watering and feeding diet of an English herbaceous border.

Thirty years later the use of Cali-

fornia natives as successful landscape plants was becoming better understood thanks to fine books such as Marjorie G. Schmidt's *Growing California Native Plants*, published by UC Press in 1980. It seems that at last the real plants of our State were actually being accepted and welcomed home again—what an irony.

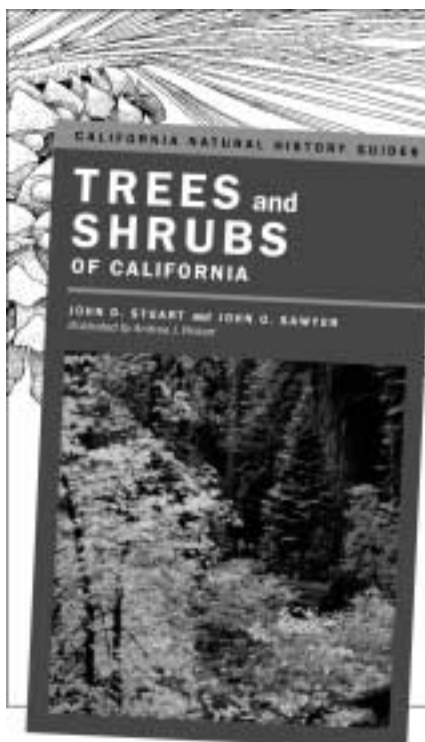
Now the publication of Judith Lowry's challenging book leads native plant gardeners into the 21st century with a gentle but compelling logic that suggests gardening be approached from an entirely different viewpoint. Her book's subtitle, *Restoring California's Native Landscapes at Home*, shows clearly that "home" for Lowry is as much in her wildland garden as in her wild heart. She urges us toward a new gardening ethic coming primarily from the native heart rather than conventional Old World plant formulas.

This "must read" book is poetically visionary, pointing also to a radically different way of thinking about landscape design for the coming century. Before the inevitable second edition goes to press my hope is that more telling color photographs will be chosen to fully illustrate the book's im-

portant theme, while Ane Carla Rovetta's attractive chapter opening drawings are given fuller display.

Gardening with a Wild Heart consists of many thoughtful essays that are as skillfully woven together as a Native American basket. Lowry's writing style has the flavor of a Barbara Kingsolver novel, so even people who are not particularly interested in gardening or garden books will find absorbing reading here. At one point Lowry finds herself at a Mendocino hot spring. On climbing out of the pool she notes one of her hands resting on concrete and the other on native rock. She writes, "Regarding the seam between the two materials, a hardened flow between substances, it occurred to me that this is the place where I have come to garden: at the seam between the wild and the cultivated, where they merge and mingle, the shape of one giving shape to the other." Lowry often lures readers beyond that seam into California's vanishing wild garden where she might spend a day napping in a bed of flowering cream cups or collecting for her seed company, Lerner Seeds, of Marin County.

Sometimes in her compelling writ-



"I love this book."
—Jake Sigg, President, California Native Plant Society

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ing Lowry despairs at the erosion of natural values but then at other times suggests hopefully that overall maybe those values will prevail. "On those days when the spent blossoms of sky-colored ceanothus drop on our breakfast dishes and in our hair and the young oak blooms for the first time, on those days when pleasantness and goodness surround us, it seems that we will."

Certainly this timely book can only help Lowry's pace-setting vision become a reality.

—Nory Nisbet

Native Landscaping from El Paso to L.A., by Sally Wasowski with Andy Wasowski. 2000, 184 pages, 217 color photographs. Contemporary Books. \$22.95.

The Landscape Revolution, by Andy Wasowski with Sally Wasowski. 2000, 166 pages. 152 color photographs. Contemporary Books \$27.95.

There's nothing like being in exactly the right place at exactly the right time. That happy event has happened to

Sally and Andy Wasowski. The publication of their two latest books coincides perfectly with the fact that now, at long last, even the most conventional thinkers appear to agree that global warming is here for real. Thus, badly designed gardens will be especially vulnerable to our changing climate—one reason why the Wasowski's books are so timely. They show that gardens are most successful when plants are grown that are native to their regions and are thus able to survive the challenges of dramatically rugged climate conditions. Of course their sage ideas apply worldwide, but these books focus particularly on the gardens of New Mexico and Arizona through West Texas and Nevada to southern California.

The Wasowskis have spread the gospel of native plants by producing no less than nine books and over a hundred magazine articles. No wonder their website is "<http://www.botanicalmissionaries.com>."

Native Landscaping from El Paso to L.A. is informative and well designed, using handsome full-page photo-

graphs for chapter openings that always complement the interesting text. Little wonder it was selected by the American Horticultural Society as one of the top 75 gardening books of all time. The book's first section discusses attractive approaches to landscaping in southern areas including the sophisticated concept of "envelope gardening." The second section is an extensive, superbly photographed glossary of the many suitable landscaping species that are indigenous to those regions. Also included are extensive and wonderfully detailed charts and a zone map to help guide plant selections for numerous varied climatic regions including Tucson, Las Vegas, and San Diego.

The Landscaping Revolution takes an amusing, "in your face" approach to the serious matter of environmentally dumb gardening. Many people have already suggested the solution but it cannot be shouted out again too loudly. That is why this book is successful. The cover and interior graphic design take a sort of "wham, bam, here

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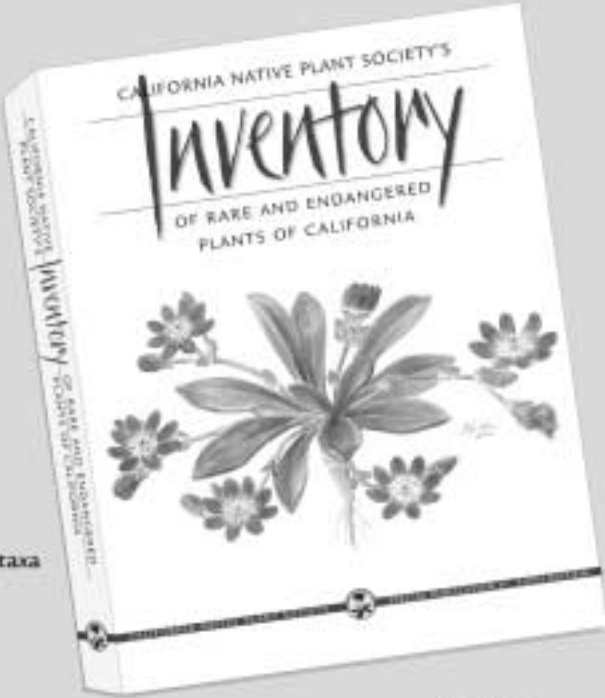
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I am" approach, with chapter openings that give you a brisk visual kick.

Doubtless this visual guerilla warfare approach is designed intentionally to wake up readers to the great importance of the Wasowskis' message. They debunk the conventional suburban garden with its immaculately pruned shrubs that are often entirely unsuited to the area, and attack labor-intensive lawns that do nothing but waste water and gulp pesticides. Readers who feel trapped by this slave labor approach to gardening will find that the shackles drop off after following the Wasowskis' advice advocating the extensive use of native plants, relaxed landscape design, and pesticide alternatives. Also included are excellent essays on Landscaping Revolutionaries—enlightened gardeners who are following some aspect of the Wasowskis' philosophy.

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Certainly one wise way to prepare for likely climate changes is, as Wasowski advocates, to create a garden that is more in tune with its surroundings—an environmentally aware

garden. As this revolutionary book's title suggests, that will require a major change, or even a mutiny, by some conventional gardeners.

—Nory Nisbet

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PUBLICATIONS

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Larner Seeds presents *Gardening with a Wild Heart* by Judith Lowry, \$19.25. Include \$2.50 for our catalog of native grasses, wildflowers, trees, shrubs. Pamphlet \$3.50: *Notes of Growing California Wild Flowers*. Larner Seeds, P.O. Box 407, Bolinas, CA 94953. (415) 868-9407.

Common Riparian Plants of California by P. Faber & R. Holland. 1988. *Common Wetland Plants of Coastal California* by P. Faber. 1982. Available from Pickleweed Press, 212 Del Casa, Mill Valley, CA 94941. \$18 each plus 7.25% tax and \$3 shipping.

Flora & Fauna Books, Natural History Book & Print Specialists, 121 First Avenue South, Seattle, WA 98104, (206) 623-4727

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North Coast Native Nursery, propagator of quality California native species for revegetation, natural landscaping, and wildlife habitat enhancement. Trees, shrubs, grasses, perennials, and wetland plants for woodland, coastal, and riparian habitats. P.O. Box 744, Petaluma, CA 94953. (707) 769-1213. Fax (707) 769-1230.

Mostly Natives Nursery, growers of coastal natives and drought-tolerant plants. Open to the public. Located in Northwest Marin

at 27235 Hwy. One, P.O. Box 258, Tomales, CA 94971. (707) 878-2009.

Telos Rare Bulbs. Bulbs for your native garden, restoration projects, landscaping. Many California natives, including *Calochortus*, *Fritillaria*, *Erythronium*, *Camassia*, *Brodiaea* family. Catalog \$2.00, refunded with first order. FREE SHIPPING IN THE U.S. *Telos Rare Bulbs*, P.O. Box 4978, Arcata, CA 95518.

Intermountain Nursery. In the foothills of the Central Sierra in eastern Fresno County on Hwy 168. Specializing in local natives, i.e., *Carpenteria*, grasses, and other drought-tolerant plants. Retail hours: Mon-Sat 8-5, Sun 10-4. Retail gift shop, books, classes. Send SASE for schedule. 30443 Auberry Rd., Prather, CA 93651. (559) 855-3113. Fax (559) 855-8809. Email: intermountain@psnw.com.

Elkhorn Native Plant Nursery. Growers of CA natives for restoration and landscapes. Services include restoration and landscape consultations and site specific plant material collection. Visit our nursery and demonstration gardens on beautiful Elkhorn Slough at the center of Monterey Bay. (831) 763-1207.

SERVICES

Environmentally sensitive landscape design. Stevee Duber, Landscape Architect, CA license #4316. Specializing in native plants for the California garden and landscape. (510) 524-8665.

EDITORIAL

One of the best ways to celebrate the wonderful botanical diversity of California is by gardening with natives. Bart O'Brien has helped gather material that we hope will inspire you, and also help you to understand the ethical challenges of gardening with natives. After philosophical considerations, we offer you resources: Sue Rosenthal and friends have compiled a list of valuable books, nurseries, seed sources, and web sites; Vivian Parker has assembled a special index to horticultural topics pub-

lished in *Fremontia*. We invite you into the garden with a special reprint of Marjorie Schmidt's 1975 "How to Grow Globe Lilies," and the new "Growing California Redwoods," by Lori Hubbard. Our final piece by Allan Schoenherr is a short but thoughtful discussion of the history behind and implication of the names of our magnificent state trees.

We all note with great sadness the passing of four great contributors to botany in California: Herbert Baker, Lincoln Constance, Jack Major, and

June McCaskill. Tributes will appear in later issues of *Fremontia*.

As the new Editor of *Fremontia*, I thank past Editor Phyllis Faber, Interim Editor Diane Renshaw, and their entire production team, for many years of excellent reading. They have set the standard high with their hard work and level of excellence. Our new team still includes Beth Hansen-Winter, designer, who has created the new fresh look for *Fremontia*. We hope that you find it attractive and easy to read.

Linda Ann Vorobik, Editor

CONTRIBUTORS

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Marjorie G. Schmidt (1905-1989) is the author of *Growing California Native Plants* and was a frequent contributor of *Fremontia* horticultural articles.

Allan A. Schoenherr is author of *A Natural History of California* and Professor of Ecology at Fullerton College.

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